Polymers in Agriculture and Horticulture

Roger Brown

ISBN 1-85957-460-2
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Macromolecules
33, No.6, 21st March 2000, p.2171-83

Title: EFFECT OF THERMAL HISTORY ON THE RHEOLOGICAL BEHAVIOR OF THERMOPLASTIC POLYURETHANES

Authors and affiliation: Pil Joong Yoon; Chang Dae Han
Akron, University

Abstract: The effect of thermal history on the rheological behaviour of ester- and ether-based commercial thermoplastic PUs (Estane 5701, 5707 and 5714 from B.F.Goodrich) was investigated. It was found that the injection moulding temp. used for specimen preparation had a marked effect on the variations of dynamic storage and loss moduli of specimens with time observed during isothermal annealing. Analysis of FTIR spectra indicated that variations in hydrogen bonding with time during isothermal annealing very much resembled variations of dynamic storage modulus with time during isothermal annealing. Isochronal dynamic temp. sweep experiments indicated that the thermoplastic PUs exhibited a hysteresis effect in the heating and cooling processes. It was concluded that the microphase separation transition or order-disorder transition in thermoplastic PUs could not be determined from the isochronal dynamic temp. sweep experiment. The plots of log dynamic storage modulus versus log loss modulus varied with temp. over the entire range of temps. (110-190°C) investigated. 57 refs.

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Roger Brown

ISBN 1-85957-460-2
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1 Introduction

The origins of polymers in horticulture are said to date from 1948 (113) when Professor E.M. Emmert had no money to buy a glasshouse and had the idea of covering a wooden structure with cellulose paper, which he replaced with polyethylene film when it became available. This inventive gentleman is also credited with inventing plastic mulch and row covers.

The use of polymers in agriculture and horticulture on a significant scale started as far back as the early 1950s when low density polyethylene (LDPE) was used in trials to replace paper for mulching vegetables. The optical properties of plastic films were also investigated as a replacement for glass with the cladding of frames and greenhouses in mind. The plastics industry itself was then young and, being hungry for more outlets, was quick to co-operate with agricultural and horticultural organisations to support research and field trials and to generally promote plastics to the farmer.

It must have been clear that there was tremendous potential for polymers in agriculture and horticulture which warranted considerable resources to be applied to developing suitable materials and demonstrating their performance. The largest scale application was coverings for greenhouse structures but another example is the development of technology that led to the first drip irrigation system in the open field in Israel in the late 1950s. The potential was significant enough that the term plasticulture was coined and in 1964 the International Committee for Plastics in Agriculture (CIPA) was formed. Plasticulture is not now found in all dictionaries but the subject is very much alive and there is still the important journal Plasticulture. This publication has defined plasticulture as a set of advanced technologies which take form as the multiple uses of plastics in agriculture. The CIPA, which interestingly was instituted for 99 years, is still alive and information can be found at www.plasticulture.com.

In 1973 Keveren (282) wrote a staggeringly comprehensive review of plastics in horticultural structures. By that time, the use of polyethylene and other polymer tunnels was well established in commercial horticulture in a number of countries. Interestingly, a gardening book for amateurs published at that time makes only a passing reference to plastic with no distinction between different materials and gives the impression that the author did not approve of such things. At grass roots, amateurs were not completely dismissive as in 1978 Keveren and the present author gave a talk to a local gardening club with the title Plastics in Horticulture.

Farmers and gardeners are sometimes considered to be rather cautious and traditional so that even in the 1970s there would have been many people, amateur and professional, still highly suspicious of ‘new fangled’ plastics getting near their plants or animals. Now we would be surprised to see a commercial tunnel covered in glass, clay pots are museum pieces and large black polyethylene covered bales are commonly seen in fields.

A cautious approach to adopting polymers was warranted. Early experiments with film covered structures were not successful and the first polyethylene films lasted not much more than a year in the UK. Generally, there was a rush into making all manner of goods from plastics with scant regard for whether the chosen material or the design was really suitable, which led to plastics being associated with cheap and nasty products – poor substitutes for the real thing. Early polystyrene seed trays demonstrated that horticulture did not escape this problem.

Subsequently, the great success of polymers in agricultural and horticultural applications reflects the trend in many industries where traditional materials have been increasingly replaced on cost, and perhaps more importantly, on performance grounds. Wood, natural fibres, glass, ceramic and metal have all been replaced in products as diverse as working clothes, parts of tools, machinery components, plant containers, packaging and mulches. However, it has not only been a matter of polymers replacing traditional materials because use of polymers has allowed the introduction of many new products such as drip irrigation and direct covering materials. Certainly, use of polymers has made an enormous contribution to increased yields, earlier production and efficiency.

Polymers now pervade all aspects of agriculture and horticulture and the range and variety of products is enormous. The object of this review is to give an outline of the roles polymers play in this spectrum of applications. Classifying the range of products into different groups is not easy so that the section headings used here are rather inexact. For example, mulching could be water management or soil conditioning and all crop protection conditions soil.

2 The Market

It has been made clear in the introduction that the market for polymers in the agriculture and horticulture industry is extremely diverse; it started in the early days
of the plastics industry and grew very rapidly to become of major importance. A history can be found in *Plasticulture* (113). Although there is vast diversity, the mainstream of plasticulture is said to be the technologies around the greenhouse industries and the volume statistics confirm this.

Reliable and systematic figures for the size of the sector are somewhat scarce. As indication of growth, Keveren (282) quoted figures for Japan (the largest user of plastics in agriculture at the time) as 8,000 tons excluding irrigation, drainage and packaging applications growing to 37,000 tons in 1965 and 110,000 tons in 1970. Another estimate gave 254,000 tons including tubes and packaging of which 164 tons was polyvinyl chloride (PVC), 74,000 polyethylene and 14,000 polypropylene. The split of polymers illustrates the greater use of PVC coverings in Japan compared to most other countries. In the UK in 1956 the split was 60% polyethylene and 40% PVC and other polymers.

A previous review report (281) published in 1988 gives a global consumption of plastics in agricultural use as approaching 3 million tonnes. PVC film was said to account for 200,000 tonnes and polyethylene between 680,000 tonnes and 845,000 tonnes excluding packaging. Other uses were much smaller but far from insignificant with France requiring 35,000 tonnes for fertiliser bags, Algeria using 6,000 tonnes for packaging fresh produce and 20,000 tonnes of polypropylene (PP) twine was consumed by French farmers. The variation of estimates of consumption is such that the total market for plastics in the agricultural sector was reported in 1994 to be about 2 million tons (13). About 50% of this was used for protected cultivation in greenhouses, tunnels, mulching and temporary structures for fruit trees, etc. A figure quoted in 2000 gives the worldwide consumption as 2,250,000 tonnes (119).

Estimates published in 2000 (114) state that greenhouses are mainly concentrated in two geographical areas: the Far East (especially China, Japan and Korea) with almost 60% and the Mediterranean basin with about 30% of the world’s greenhouse covered area. By continent, Asia had 63%, Europe 27%, Africa 5% and America 5%. The area covered by greenhouses has been steadily increasing at something like 20% per year from ~100,000 ha in 1980 to more than 485,000 ha in 2000. The most dramatic increase was in China from 6,500 ha in 1980 to more than 200,000 ha in 2000.

Although the statistics for polymers in agriculture are very impressive, the sector is actually relatively small. Current estimates for Europe (a.1) give agricultural consumption as 695,000 tonnes representing 2% of the total (packaging is given separately and is the largest sector), being even lower than leisure/sport. Film for greenhouses and tunnels was estimated at 500,000 tonnes with 50% of the total consumption for greenhouse and tunnel film and 25% each for silage and mulch films (119). LDPE is the most important polymer, accounting for 55% of consumption in France for example, followed by high density polyethylene (HDPE), with considerable quantities of PVC used in piping. The total LDPE film was given as 350,000 tonnes of which transparent crop covering film accounts for 160,000 tonnes, black silage film 148,000 tonnes, transparent mulch films 60,000 tonnes and stretch films 33,000 tonnes.

The largest use of rubber is in tyres and, interestingly, the agricultural sector accounts for 3% worldwide (bigger share than for plastics) which is worth £1.5 billion (89).

The difficulty of obtaining accurate statistics is discussed by Jouet (70) with problems due to contradictory estimates and different definitions used in different countries. He gives the worldwide total plastics consumption in agriculture (1999) as 2,800,000 tonnes, this being a 60% increase since 1990. This figure excludes materials used indirectly before and after production, such as bottles, packaging, machinery and animal hygiene, which accounts for about 14 billion Euros.

Jouet gives comparative data for 1985, 1991 and 1999 with breakdown into major applications, see *Figure 1*. Mulching consumes the greatest quantity at 650,000 tonnes followed by micro-irrigation, silage and glasshouses/large tunnels, twine, low tunnels, miscellaneous, direct covers and hydroponics in that order. A table gives a breakdown by country for area covered by greenhouses and large tunnels which confirms the dominance of use in Asia and the relatively minute amount in North America (see *Table 1*). There are also tables for area of low tunnels, direct covers and mulch plus tables for the use of silage and wrapping, hydroponic systems, irrigation and twine.

The concentration in all these figures is for arable crops rather than animals. Getting reliable figures for polymers in animal production is more difficult (112), probably because of the diverse products and materials that are involved.

It is evident from the figures quoted previously, that the distribution of plasticulture geographically is extremely uneven. In fact it can vary from a few percent of total
national plastics consumption to 25% or more. A detailed analysis of the reasons for the diverse levels of agricultural polymer use has not been found but it is clearly a function of the importance of agriculture/horticulture in a region and economic/practical pressures. The early use of plastics in agriculture was in industrialised countries, northern Europe, Japan and USA with economic incentives. There was then a very rapid rise in use in Mediterranean countries which later spread to China and South-East Asia. It is fairly obvious that a dry country such as Israel could benefit enormously from development of efficient irrigation systems, whereas there was relatively little incentive in the UK. Greenhouses and tunnels in Mediterranean countries have increased performance and efficiency where agriculture was important and the climate was already favourable. The growth of mulching in China is probably largely associated with combating soil erosion.

Achon (53) reports that Spain uses more agricultural film than any other country in Europe. An agricultural economy is traditionally seen as a poor one and Almeria in south-east Spain was once one of the poorest regions. Now it has the largest concentration of greenhouses in the world (54% of its total surface is covered) and is one of Spain’s most profitable regions. Coupled with the greenhouse concentration, a large amount of black LDPE is used for lining reservoirs to supply water. Film accounts for 42% of agricultural plastics consumption in Spain with 33% in tubing, 15% in twine and nets and 6% in reservoir lining (119). Further details for Spain are given in Spanish only (20). Spain is clearly a leader in plasticulture and the only book found on the subject is Plastics Films in Agricultural Production, published by the Spanish company Repsol YPF.

Developments in plasticulture in Latin America have been described in some detail (40) with accounts being given of the situation in six countries. The economy in these countries is mostly based on agriculture and it is understandable that modern

### Table 1. Area covered by agricultural applications in 1999 (hectares) (70)

<table>
<thead>
<tr>
<th>Geographical area</th>
<th>Greenhouses and large plastic tunnels</th>
<th>Low tunnels</th>
<th>Direct covers</th>
<th>Mulching</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>27,000</td>
<td>80,000</td>
<td>6,000</td>
<td>32,810</td>
</tr>
<tr>
<td>Middle East</td>
<td>28,000</td>
<td>32,000</td>
<td>-</td>
<td>47,190</td>
</tr>
<tr>
<td>America</td>
<td>22,350</td>
<td>30,000</td>
<td>6,000</td>
<td>200,00</td>
</tr>
<tr>
<td>Asia</td>
<td>450,000</td>
<td>170,000</td>
<td>14,000</td>
<td>9,760,000</td>
</tr>
<tr>
<td>Europe</td>
<td>163,830</td>
<td>90,000</td>
<td>60,000</td>
<td>450,000</td>
</tr>
</tbody>
</table>


Figure 1

World consumption of plastics in agriculture in 1999 (tons) (70)
methods are being rapidly adopted and even being developed. Argentina has some 2,500 plastics companies, mostly small and medium sized, and greenhouse area grew 20% between 1999 and 2001. The challenge in Venezuela which can only be met by plastics is to extend the agricultural coverage to the tropical regions. Cuba has similar climatic problems and growth in many areas of plastics in agriculture is being seen. Important crops in Ecuador are bananas, which use about 28,000 tonnes of polyethylene per year, and flowers which use plastics in many applications, and for which the market is growing at 10% per year. Plastics usage is relatively modest in Guatemala and small in El Salvador.

The use of plastics covered greenhouses for the protected cultivation of fruit trees in Japan was examined and developments in environmental strategies and cost reduction discussed (191).

Plasticulture is now a very international business. In Nepal cucumbers are grown in PE tunnels to enable production out of season (71). India has a large area under drip irrigation and has a significant production capability which exports nearly 20 million pieces of drippers per year (93). Biodegradable films for mulching have been studied at an agricultural improvement station in Taiwan (120). The development of strawberry production has been examined (143) and there have been reviews of plasticulture in Israel (181) and in Egypt (188).

It is clearly a misconception that plastics are for the rich countries (a.2). It is also obvious that plasticulture can be very important in developing countries but whether the funds for its use are available is another question. Although it is theoretically true that plasticulture enables vegetables to be grown in countries where they were a luxury, and hence nutrition and health can be improved, again, such fine ideas depend on investment.

The foregoing essentially addresses commercial agriculture/horticulture, which is where the bulk use of polymers lies. However, there is a significant amateur gardener market which will also be considered.

3 Materials

The vast majority of polymer used in agriculture is in the form of plastic film used in plant protection, covers and mulching. Low density polyethylene is the dominant film material being used in all forms of mulch and cover. Polyethylene (PE) is also used in nets, hydroponics pipes and containers. Most PE film is clear or translucent but large amounts of black material are used for silage and reservoir linings. Opaque white outer and black inner is also used for silage. Much smaller amounts of white and coloured film are used for specialist applications. PVC film is also extensively used in mulching and covers and became particularly popular compared to polyethylene in Japan. PVC is also used in pipe. Linear low density polyethylene (LLDPE) and ethylene vinyl acetate (EVA) films are also used in quantity. Over the years there have been many developments in the formulation of the polymer compounds to improve performance and the introduction of coextruded films having as many as five layers to optimise required properties.

A chapter on the application of plastics film in agriculture (13) is somewhat vague but does give an outline review of film stabilisation, factors affecting stability of greenhouse films, ageing resistance and recycling. A brief review of several applications of plastics in agriculture is given by Kumar and Singh (47).

Polypropylene is used extensively in nets, twine, pipes and containers, while some polycarbonate and polymethyl methacrylate (PMMA) is used in glazing. The natural and synthetic rubbers used in tyres also constitute an important volume of polymer used in agriculture.

The dominance in tonnage terms of the main film materials rather overshadows the fact that the vast diversity of products used in agriculture involves the application of the widest possible range of polymers. In fact it is difficult to think of a material that has not found some agricultural use: polychloroprene rubber in milking liners, fibre reinforced plastics tanks, various engineering plastics in machinery parts, fibres in clothing, foam insulation for buildings and so on. Consequently, there are opportunities in agriculture for just about all sectors of the polymer industry. A list of plastics used in agriculture by type is given in Table 2.

One interesting link of agriculture with polymer production is the increasing use of vegetable-based fillers and fibres to replace the more traditional inorganic fillers and glass fibre. It is in principle a win-win situation because the vegetable products are otherwise waste and the plastics industry can gain on cost and perhaps aid biodegradability.
Crop protection is defined here as the use of covers placed over plants whilst they are growing. Hence, it comprises greenhouses/large tunnels, small tunnels and direct covers, but excludes mulch.

The purpose of providing protection is to increase the yield and/or to extend the cropping season. The basic and main form of protection is achieved through regulating the temperature and moisture levels, and eliminating wind and possible damage from heavy rain, hail or snow. Such protection can also modify the spectrum of light reaching the plants which modifies their growth. The mechanics of this type of protection primarily involves a covering of film, but netting is sometimes used when shading is required to reduce temperature. Windbreaks are a permeable wall rather than a covering. Secondary advantages of greenhouses and large tunnels is that they additionally provide shelter for the workforce.

The other form of protection is to prevent pests reaching the plants, which is generally achieved with netting or mesh. Whilst in principle a film covering could protect against pests, in practice the conditions are such that problems are usually made worse because the environment created suits the pest as well as the crop.

The largest use of protection is for vegetables but is also used for fruit, flowers, mushrooms and nursery stock.

Protection could be thought of as an accelerating process for yield, and the acceleration is relative. Hence, covering can be effectively applied not only in a relatively cold climate where cropping may not even be possible without protection, but can be even more effective and important (especially in economic terms) in improving the already good results obtainable in a relatively warm climate.

### 4.1 Greenhouses/Large Tunnels

A greenhouse is defined as a large structure in which it is possible to stand and work. A large tunnel is simply a particular form of construction. In such a structure a high level of control of temperature, moisture, ventilation, shading, etc., can be achieved and tall growing species accommodated. Traditionally, a greenhouse was a wooden or metal frame with glass, or later rigid plastic, panes and that form is still the norm for amateur use and where aesthetics are important. Much cheaper tunnel structures can be made with simple tubular metal framing and a flexible film covering and this has been the most popular commercial approach. However, a great variety of constructions have been developed including inflated double skin roof, multi-span houses and the use of rigid or semi-rigid plastics end covering.

A quite detailed discussion of the design and construction of plastic film greenhouses has been given by von Zabeltitz (72). The design of a greenhouse involves consideration of the imposed forces generated by outside weather conditions of storm, rain, hail and snow as well as crop and structure loads. A European standard, EN 13031 (a.3) exists for the design of plastic film covered greenhouses which it is said could form the basis for use in countries outside of Europe. This standard gives rules for structural design, including requirements for mechanical resistance and stability, serviceability and durability, and the scope extends to cover the foundations.

The article outlines different requirements in different climates and for different crops, and discusses practical construction details such as the need to isolate the film.
covering from metal supports to avoid locally overheating it, the need to avoid anything that hinders the run off of water droplets and the ratio of ventilation area to floor area. Comparison is made between the simplicity of the single span tunnel and the advantages, but higher cost, of multi-span gutter-connected constructions in terms of space utilisation, efficiency of ventilation and prevention of dripping. Some examples are given to demonstrate different factors.

Inherent limitations of greenhouse films are their modest strength and working lifetimes, although considerable improvements have been made over the years. A combination of choice of film and the frame construction needs to be made to ensure satisfactory performance in the given situations. The continued increase in the use of film covered structures indicates that even modest lifetimes compared to many product areas is economically satisfactory.

An outline of the properties of the covering is given with some figures for a polyethylene cover. The light transmittance between 400-760 nm wavelengths was 86.2% when new but fell to 78.8% at one year old and dirty or 85.2% when cleaned. After three years the figures were 56% dirty and 85.2% cleaned, illustrating the good ageing performance of the film but the considerable penalty in loss of light if cleaning was not undertaken.

Most consideration of greenhouses is directed towards the Mediterranean and temperate climates but simple cheap wooden frames with film or net coverings have been developed in the Seychelles (173).

Rigid plastic sheet has the advantage of strength but is an expensive option and much less often used than film. However, it has considerable popularity for amateur greenhouses because of safety compared to glass. Corrugated and plain PVC, horticultural grade acrylic (PMMA) and more recently styrene acrylonitrile (SAN) are available. The other option is twin or triple wall polycarbonate which offers exceptional energy saving (although highly diffuse).

Plastic films for greenhouse covering act as a filter, selectively allowing radiation of different wavelengths to go through. The visible light region from about 380-760 nm roughly covers the photosynthetically active region (PAR) of the spectrum which is essential for the development of plants. When other requirements of water, temperature, CO₂ and nutrients are satisfied, growth will depend on light received. In sunny conditions the covering needs to diffuse the light since shadows are reduced and the light is more efficiently used, plus scorching is prevented.

Some transmission figures (114) show that 0.2 mm thick LDPE has total transmission in the 87-89% region but different materials range from 80% down to 48% for direct transmission. EVA is given as 90-92% total and between 60 and 91% direct, and PVC as 87% total and 78% direct. A retail supplier’s catalogue quotes transmissions of 92% for horticultural acrylic and 90% of the transmission of glass for Twinwall polycarbonate.

At night, the longer wavelength infrared light is emitted by plants and soil and causes the cooling of the greenhouse. The lower the transmission of infrared radiation through the covering the better is the heat retention, and the greater the ‘greenhouse effect’. Thermic films are defined in the EN 13206 standard (a.5) as those that let through less than 20% of the radiation in the wavelength range 7-13 µm. Thermic films are also good diffusers of light. As an example (114), an experiment using a thermic film gave an 8% increase in yield with a 16% saving in heating fuel. A detailed consideration of thermal films has been given in Spanish (80). A modification of the ratio of red to far red light transmitted by a film can prevent plants becoming ‘leggy’ (92). In a different context, an infrared blocking film helps to keep the temperature down in conventional glasshouses (101).

If fluorescent or phosphorescent molecules are added to a film covering, certain wavelengths may be absorbed and re-emitted at more photosynthetically efficient wavelengths, and the film is said to be photosensitive (53). Russian tests (63) have demonstrated the value of UV absorbing luminophores based on europium compounds to shorten maturation time, accelerate growth and increase yield by up to 100%. The effect of both photochromic and thermochromic additives in a range of greenhouse films on photodegradation was investigated by following mechanical property changes in both natural and accelerated ageing (143).

Coloured film coverings can block particular wavelengths and hence affect growth. One case of photo-selective film is filtering out far red light to produce shorter stemmed plants as an alternative to chemical growth regulators (a.6). Like the use of coloured mulches discussed later, there is considerable scope for experimentation and potential applications are extensive and exciting.
to film covers a broad spectrum of properties that can be introduced/modified (31). A combination of anti-fogging and UV stabiliser was reported to be under trial (73). The effectiveness of UV stabilisers and the interaction with the effects of absorbing UV is discussed (95) together with the effect of pesticides on stabilisation.

To reduce heating costs in a greenhouse means either growing a crop that will require lower temperatures or improving the heat loss through the covering. Double polyethylene glazing is very popular in the USA (a.4) and a conservative estimate of energy saving is 33%. With newer infrared barrier films this could reach 45%. Bubble insulation material made from triple laminated film is available for attachment to the inside of greenhouses to provide insulation in winter.

Leonidopoulos (104) has published calculation methods to give the greenhouse temperature as a function of size, shape, time and outside temperature and also a study (105) on the relation of sun intensity and temperature. The heterogeneity of climate and airflow pattern in a plastic tunnel was investigated and crop transpiration was found to vary by up to 30% (44).

4.2 Low Tunnels

Low tunnels or row covers could be thought of as a development from the glass cloche or Dutch frame traditionally used in market gardening, over which they are much more efficient. In fact, it was the availability of polyethylene film that made economic row cover on a large scale possible.

Small tunnels are much less expensive than greenhouses (although more expensive than direct covers) but essentially do the same job. There are obvious restrictions and disadvantages compared to greenhouses but they are very effective in the right circumstances, for example for short-term cover of low growing crops.

Construction varies but essentially a simple frame of hoops stakes and wire supports a film covering to give a typical cross section of 40-50 cm high and about 120 cm wide. The edges of the film may be buried in soil or pinned down. The restricted volume and access means that care has to be taken with ventilation to avoid overheating and high humidity by opening the tunnel when necessary. Consideration also has to be given to providing the plants with sufficient water. Obviously, the small size restricts the material that can be grown and very often the tunnel does not remain in place for the whole growing period of taller species.
The film covering is usually polyethylene, essentially the same as used for larger tunnels. However, in the Middle East it is common for non-woven fleece coverings (see Section 4.3) to be used stretched over a frame (77).

For amateur use, similar tunnels on a smaller scale are sold but there are also cloches and frames with rigid or semi-rigid plastic construction. Cold frames are also quite popular with amateurs and can also still be seen in nurseries. Plastics used include PVC and twin wall polycarbonate.

### 4.3 Direct Covers

These can be considered as frameless low tunnels, hence the term unsupported row cover. Interestingly, direct covers were developed later than tunnels indicating that it took time to realise that plants can thrive whilst holding up their protecting cover, although in reality it needed to wait for the introduction of perforated films and non-woven fleece. The film or fleece is generally several metres wide and is laid very loosely with the edges held down with earth. The covering will then float in the wind and expand as plants grow, hence the other name of floating cover. The growth in the use of direct covers has been rapid, no doubt influenced by the low cost.

The covering is generally either perforated polyethylene or non-woven cloth or fleece because it needs to be lightweight and to allow the passage of water for irrigation and air for ventilation. The covers provide the same functions as low tunnels in that they act to conserve heat, prevent excessive transpiration, protect from wind and heavy rain and exclude pests, but the level of protection is different because of the intrinsic ventilation and the absence of a frame. If the cover is made of a very fine mesh it will be particularly effective for excluding pests such as carrot fly but allow good ventilation and passage of water.

Non-woven fleece cover in Europe (77) is typically in the weight range 17-20 g/m² and several rolls of material may be joined with adhesive to give a total width of up to 16 m. Experience showed that improvements in durability of the fleece without increase in fabric weight were desirable and one manufacturer initiated a development programme in cooperation with the polypropylene supplier and the Scottish Crop Research Institute. This led to production of an in situ formed bi-component filament which resulted in improved strength properties which were subsequently proven in the field.

The effectiveness of non-woven covers alone and in combination with black/white and brown polyethylene mulch on growth of squashes was investigated (136). Trials in Mexico (137) evaluated the effects of different combinations of spun bonded fabric covers, perforated and non-perforated polyethylene micro-tunnels and black polyethylene mulch on growth and yield of muskmelons, insect populations and soil temperatures.

### 4.4 Windbreaks

In exposed areas a windbreak can have a significant effect on cropping. An artificial windbreak has the obvious advantages over natural materials of consistent permeability, does not compete for water and nutrients, does not harbour pests and is moveable, although it does carry a cost premium.

Plastic windbreaks are essentially a mesh or grid of polyethylene or polypropylene supported on fence posts. Clearly, adequate strength and stabilisation against UV light are very important.

### 4.5 Shading

Shading is mostly important in very hot countries to prevent plants from becoming overheated. The use of mesh with a porosity of the order of 50-60% in tropical conditions can extend the type and season of vegetable that can be grown. It has also been used to help establish newly planted areas in parks in tropical areas of the Far East. In climates like those of Israel or Florida, nurseries without natural shade can protect their stock with shade netting. Such artificial shading material has the same advantages over natural shading as given for windbreaks, and it is also possible for it to be temporary according to season.

Even in temperate climates protection is needed for shade loving plants such as ferns and rhododendrons in nurseries. Greenhouses may be shaded with ‘paints’ or the use made of netting or various blinds.

By the use of different percentage coverage of the netting and also different colours it is possible to cater for different conditions and even different plants. One commercial range (39) of polyethylene shading netting and fabrics gives coverage from 30-90% with a large variety of colours and is treated to prevent rotting and to repel insects.
4.6 Protection Against Pests

The use of fine mesh direct covers to exclude flying pests has been mentioned and can be very effective. All the types of cover give protection against birds but generally insect pests can readily populate greenhouses and low tunnels. In fact one of the problems of using plastics for protection is that the climate that suits the plants also suits the pests. Consequently, as an example, red spider and whitefly are usually much more of a problem under cover than in the open. On the other hand, the closed environment of a greenhouse is helpful when applying pest control measures.

The effect of mulches in repelling insects will be discussed in Section 5.1.

Netting is widely used to protect fruit, particularly soft fruit, from birds. The polyolefin netting with suitably small mesh is usually attached to a frame forming a cage. A very wide mesh netting can be used to cover brassica plants against the attack of pigeons but this is probably only used on a small scale. Netting is also used on a small scale to protect fish in ponds from herons.

Very fine mesh is used to keep out pests such as carrot fly. Spun-bonded fleece used as wind and frost protection can also be effective in keeping insects out. EVA ‘cotton candy’ is said to have potential in preventing insect attack by interfering with insect behaviour (56).

Effective tree guards can be made from recycled PVC and it was reported that 20,000 have been donated by the PVC Tree Protector Campaign to tree planting and wildlife groups in the UK (85).

An unusual application of polyethylene sheet is to put it as a sleeve around mango trees to prevent mealy bugs climbing up (47).

5 Soil Conditioning

Soil conditioning is taken here to cover mulching, i.e., covering the soil rather than the plants, and the addition of materials into the soil. Covers for plant protection, particularly direct covers, achieve some of the aims of mulching but they have been dealt with in the previous section. Conversely, it can be said that mulches give a measure of plant protection by warming the soil, preventing weeds and, with reflecting films, increasing light and warding off aphids.

5.1 Mulching

Traditional mulching was the application of loose material such as composts, straw and grass cuttings around plants. The main objectives were to conserve moisture, maintain the surface soil structure and to protect it from erosion and the leaching of nutrients. In winter a mulch would act as thermal insulation for the roots in cold climates. Such mulches also improved soil structure after being incorporated by subsequent cultivation.

Plastic film used as a mulch has the advantages of lightweight and is much easier to handle as volume for volume it covers a much greater area than natural mulches and, being in rolls, is amenable to mechanised installation and, hence, has a cost advantage. Also, it should not introduce pests or chemical residues which are possible with natural materials.

Films for mulching can be distinguished by colour. Transparent materials enable rapid heating of the soil (through the greenhouse effect) as well as conserving moisture and protecting the soil, whereas black materials are effective at preventing weed growth. Reflective films, opaque white or metallised, can be used in low light conditions to concentrate sunlight onto the plants to increase photosynthesis.

Coloured mulches have been shown to be effective for a range of vegetables including cucumbers, melons, peppers, cabbages and corn (a.7) but a single colour was not suited to all crops nor effective against all pests. For example, red plastic gave best results for tomatoes for growth whilst silver mulch controlled whitefly. Similarly, coloured mulch has reduced thrips on leeks. Apparently, it is the UV light reflected by the silver mulch that repels the insects whilst a plant may be stimulated by the coloured light reflected giving the impression of there being competitive plants nearby. Blue mulch produced the best results for peppers in Mexico (148) due to the reflection of photosynthetically active wavelengths and raised soil temperature, whilst black mulch on inclined beds gave considerable improvement of pineapple yield and sugar content (164). Yellow/brown films delayed the incidence of tomato yellow leaf curl (179). An example of the use of a black mulch in a temperate climate is the advantages found for asparagus cultivation in southern Germany (192).

The quality and thickness of film will vary with the crop to be treated. For short-term crops, which includes most vegetables, the period is in the 3-6 month region and standard thin film will be satisfactory. However, for long-
term service in situations such as in vineyards and orchards several years life will be expected and the films will be upwards of 50 µm with high mechanical properties and high protection against degradation.

Normal films could not be incorporated into the soil by subsequent cultivation, and for mechanical harvesting may need to be removed in advance to ensure that they do not block or damage machinery. However, films made of photo/biodegradable materials will break down with time and this time can be programmed to suit crop requirements and the amount of sunlight available (latitude). See Section 13 for information about degradable materials.

Woven HDPE or polypropylene fabric is used as permeable ground cover that prevents weeds and provides a clean and good looking surface for the display of plants in nurseries. It commonly has lines marked to aid with pot spacing.

Black spun bonded polypropylene mulching film for suppressing weeds has pre-cut cross holes for planting individual plants through.

Bark is widely used where a decorative mulch is required but this can be replaced with a coloured mulch based on rubber from recycled tyres which avoids the need for relatively frequent replacement (45, 86).

A short-term use for a covering of film is in the disinfection of soil when the film helps to raise temperature and/or to retain chemicals. In hot regions the temperature under the cover can be sufficiently raised through the greenhouse effect to cause solar disinfection without the need for chemical treatment. The traditional use of methyl bromide is being phased out (42) but other chemicals to replace it will need a plastic covering.

5.2 Soil Improvement

Natural soils vary considerably in their composition and structure and most can be improved by the incorporation of organic matter and in some cases from addition of inert materials. Hence, the addition of manure, etc., has been practiced since time immemorial. Very much more recently polymeric materials have been used for soil improvement.

The main applications have been in sports turf and amenity areas where the intention was to increase the strength and resistance to wear of the turf rather than to improve soil in the classical sense. One basic approach is the incorporation of geotextile materials as a grid or mesh which then acts as a mechanical binder. Another approach is to add shredded rubber waste from tyres, an example of which is reported for a softball field (48).

One of the main improvements given by traditional materials is the improvement of water holding ability and consideration has been given to the use of scrap polymer foam which would hold water as well as alter mechanical structure. For the use of water holding polymers see Section 6.3.

The Russian Academy of Sciences has developed a method to help soil recover from the effect of the mining industry (36). A water-based emulsion is applied to the freshly seeded soil surface and forms a permeable film which binds the soil particles ensuring that the top surface stays in place. The film is air and water permeable and plants can readily grow through it. It stays in place for several years before biodegrading.

The breakdown of biodegradable plastic mulches will result in residue being incorporated into the soil and investigation is needed of the long-term effects on soil quality.

6 Water Management

The simple fact is that the geographic and seasonal distribution of rainfall is extremely variable and in many areas there are periods when the amount is insufficient for growing crops. Furthermore, the demand for water is increasing and the extra is not available. In many cases agriculture is the main consumer of water (49) and it has been estimated that only 40% of water used in agriculture actually reaches the plants. In consequence, there is a huge requirement for the management of water for agricultural and horticultural use. Clearly, the need is greatest in arid regions but it can also be a limiting factor in temperate regions and to use less water would reduce costs.

A general discussion of the use of plastic materials for the management of irrigation water is given by Losada (111) which makes the point that plastics have contributed to a real revolution in irrigation in many ways, from the irrigation equipment to the control of water by mulching. A suggestion is made as to what irrigation would have been like without plastics for the last 50 years.
In complete contradiction, there are circumstances where there is too much water and land has to be drained to make it viable for cultivation. Here again, plastics have been fundamental in important innovations.

### 6.1 Collection, Storage and Transport of Water

The great majority of systems for the collection and storage of water are shared by industry, domestic and agriculture needs but there are boreholes, wells and reservoirs which specifically serve agricultural purposes.

Plastics are present at the start of the process – PVC pipes are used to transport water from bore holes and film or sheet can be used in channels to divert water to storage positions.

Water is efficiently stored in reservoirs created by excavation which are lined with a polymeric sheet to prevent loss by seepage. PVC, EVA, HDPE, LDPE, ethylene-propylene diene monomer (EPDM) and butyl rubber have been used and enormous structures are possible with thick polyethylene sheet. The use of PVC sheeting for agricultural reservoirs has been described (110). An additional use of polymers can be in water storage through the geotextiles used to protect the reservoir lining. The rainfall in Spain is inconsistent which encourages the building of irrigation reservoirs (53). HDPE, LDPE, EPDM and butyl rubber have been used and the average size is said to be 50,000 m\(^2\) with an exceptional reservoir in the crater of a volcano in the Canary Islands of 4,000,000 m\(^2\).

A novel type of dam (a.8) uses two polyethylene liners contained within a single woven outer tube. The two liners are filled with water and they then form a stable non-rolling dam barrier.

Transport of water from the storage facility can be by pipe or open channel but pipe clearly has the advantage of no contamination or loss. The materials generally used are polyethylene, PVC or glass reinforced plastic (GRP).

A great quantity of PVC pipe is used to carry water for irrigation to the field and for permanent underground networks in sports facilities. Polyethylene pipe is widely used in surface networks (which may or may not be intended to be moveable) to feed spray and sprinkler heads. PVC sprayline pipe can be pre-drilled at intervals for attachment of outlets. Similar networks, although on a smaller scale, provide mist systems in greenhouses and sprinkler systems for nursery stock. Additionally, there are the moulded pipe connectors and, often, the spray or mist heads are made from moulded plastics components.

Drip irrigation or micro-irrigation systems are one of the great success stories of the effect of plastics on horticulture. This approach only became feasible when small bore flexible plastic pipe with moulded connectors and drip or mini-spray heads was available. The idea was conceived in Britain in the early 1950s for greenhouse use and at first used rubber tubing (113). It was exported to Denmark for greenhouse use and then to Israel where it was developed for use in the open field. Drip systems are efficient because water is delivered exactly where it is needed and nowhere else, and loss by evaporation (very high in spray systems) is minimised. Also, the pressures needed are very low. The only disadvantage is the relatively high installation costs but the longer term economics are very favourable. Despite the efficiency, less than 1% of arable land is irrigated in this way (49). Probably it needs the incentives of water being in short supply and/or expensive to justify the investment, which would explain its high use in countries such as Israel but relatively little in the open in the wetter climate of the UK.

There is a variety of systems with various degrees of sophistication including simple perforated pipe hose (which can be buried) and self-regulating drippers. Commonly, a drip irrigation installation will be coupled with a plastic film mulch to further prevent evaporation losses.

The productivity of making pipes with drippers has improved greatly in the last 2-3 years through improved technology which should reduce costs (49) and perhaps aid the adoption of this approach to irrigation.

Sprinkler systems are widely used by amateur gardeners but they are also increasingly turning to drip systems, particularly in such countries as Israel and the hotter States of North America, and also in the UK. One attraction is the possibility of automatic/timed systems.

### 6.2 Irrigation

Simplistically, irrigation systems can be categorised as flooding, above surface spraying or sprinkling and drip irrigation, and they could be ranked in that order for increasing efficiency.
A different type of irrigation is found in capillary matting made from non-woven polyester fibres and used in greenhouses. In addition to the mat itself there is likely to be a polyethylene sheet beneath it and a perforated sheet above to reduce evaporation.

6.3 Water Holding

Water is held in soil by the organic content but this can be augmented to cover dry periods by the introduction of artificial water holding materials. Hydrophilic gels are generically known as hydrogels and there are a number of trade names. They have the ability to hold many times their own weight (300-1500 depending on the product) and to release it as the environment becomes dry (a.9). These polymers have been available for 20 years but interest has varied.

Starch-based hydrogels have a very limited life but polyacrylamides and polyacrylates are much more stable, remaining active for two years or more. The gels are claimed to increase available water, improve aeration, reduce compaction, improve drainage and increase plant survival and growth. It appears that enthusiastic claims are made about the improvements that these products can make but research results have been conflicting and controversial. The author of (a.9) gives a fine example of how marketing blurb has turned a complete failure into a magnificent success for the product.

A pioneering hydrogel material is Broadleaf P4, the benefits of which are outlined on the web site of the manufacturers (a.10). Other materials are called Stockosorb (a.11) and Erisorb (a.12). The makers of Erisorb also produce a flocculent material based on polyacrylamide called Eribond which is said to bond soils to prevent erosion. There are some potential environmental issues relating to polyacrylamide use. Polyacrylamide is designed to be resistant to biodegradation, thus there is the possibility of long-term accumulation, but this fear is unfounded if polyacrylamide is used at low concentrations. The monomer used to synthesise polyacrylamide is a neurotoxin. However the polyacrylamide is supplied almost devoid of monomer, so the presence of the monomer in the environment should be minimal. Possible alternative natural polymers have also been considered (121).

In principle, polymeric foams could be incorporated into soil to absorb water but this does not appear to have been adopted. Simple trials by the author with polyurethane foam were inconclusive.

An investigation of the feasibility of the application of polymers to facilitate the growth of plants in arid lands (11) is looking at whether a polymer can be synthesised to encourage precipitation of moisture in the air and at polymers that absorb water through crystallisation.

6.4 Drainage

The majority of plants do not like waterlogged soil because of the lack of oxygen, and it can result in reduced yield or, in the worst case, death of the plants. Excess water will also restrict access to crops or animals. Consequently, there are many instances where drainage is essential to reclaim land for agriculture or is desirable to improve yield.

Traditionally, the only methods were ditches, runs of coarse aggregates and clay pipes. Clay pipes are brittle, heavy and the laying process is labour intensive. Ditches became blocked, requiring perhaps annual maintenance, and waste land. The introduction of plastics pipes allowed a dramatic improvement in the ease and efficiency of field drainage.

Originally, rigid perforated PVC pipes developed by Wavin in 1956 were used but they were not totally satisfactory for strength and flexibility. Flexible corrugated pipe in long lengths was introduced in 1962. Such pipe can be machine laid very rapidly and its use is much more efficient. Pipe may be made from polyethylene, polypropylene or PVC, with PVC having the best strength and stiffness to weight ratio, but polyethylene is good at low temperatures.

The design of a drainage system is a specialised process. Consideration has to be given to soil loading to ensure pipes will not fracture and it may be necessary to include non-woven geotextile layers to prevent clogging of the pipe.

7 Harvesting and Crop Storage

Polymers contribute to the harvesting of crops in the form of containers such as nets, bags and crates. The advantages over more traditional materials include light weight and ease of cleaning/disinfecting. Plastic crates can be moulded to particular forms to suit the crop and are reusable. The containers used at harvest are in many cases suitable for transporting the crop to store or market without damage.
Film can be used in several ways for the storage of grain – to line existing pits or silos, cover sacks stacked on a damp free base or to directly produce storage containers. In all cases the low permeability to air and moisture and low cost are attractive. Probably, the use of film as a covering for sacks in the open is expedient in times of exceptional harvest.

In the last few years there has been a large increase in the use of polyethylene bags for grain storage in Argentina (41). The bags are essentially tubes of between 60 and 75 metres in length and the largest diameter size used carries about 220 tonnes of wheat or 200 tonnes of soya or maize. They can be stored outside and alleviate the problem of limited on-farm storage at low cost.

The trend for plastics to replace metals applies to conventional grain silos and here consideration has to be given to the electrical insulating nature of most polymers and the danger of dust explosions.

Ensilage is the process of storing and fermenting green fodder in a silo, or the fodder thus preserved (commonly called silage in the UK). The object is to produce a material when a crop is plentiful that can be stored for feeding in the winter when food is scarce. Ensilage is an anaerobic fermentation process that requires air-tight containment. Until the 1950s this could only be provided by steel or concrete structures which made it a rather difficult or expensive process. The other method of preserving fodder is by making hay which is seriously reliant on the weather and one presumes that it was the revolution of introducing plastic film containment for silage that caused it to have largely replaced hay making. Haylage is made by essentially the same process as for silage but the grass has been allowed to dry before being baled. It is wrapped in the same manner as silage.

Initially, large bags were used but stretch wrapping was invented in Australia and use of it in Britain started in 1986, and quickly spread to the rest of Europe (113). This process produces the large bales now commonly seen.

Polyethylene film is most commonly used and it has relatively low air permeability. However, co-extruded materials can improve this further. The colour is usually black but sometimes white or a black/white bi-extrusion is used, particularly in sunny climates. A white film outwards reflects light and helps avoid extreme heating of the fodder. Another important property of the film is its resistance to acidic conditions.

8 Buildings

Agricultural buildings can incorporate plastics in a number of ways which include polyethylene damp proof course material, PVC cladding, rain water goods, PVC window frames and polyurethane foam insulation. Plastic wall linings are easily cleaned and non-absorbent and hence hygienic for wall linings in milking parlours, etc.

PVC profiles have been found to be a practical and cheap option for flooring in pig breeding and fattening units (112) because of corrosion resistance, strength, not causing damage to stock and ease of cleaning and disinfecting. A similar approach is used for poultry. Foam mats from recycled polyolefin with a watertight cover were tested by the Dutch state agricultural institute HAS and it was shown that cows having floors lined with the mats gave more milk than those without such creature comforts (99).

PVC boards have also been shown to resist being kicked when used as separating walls in horse stables and again are hygienic.

9 Machinery and Equipment

The range of plastics and rubber-based components used in agricultural machinery is legion and includes polyamide gear wheels and bearings, polypropylene and GRP covers, electrical wiring and various synthetic rubber seals.

The biggest use of rubber in agricultural is for tyres. The 3% of total world market held by agricultural tyres is worth £1.5 billion. Tractors have large tyres and as the engine power has increased even larger tyres become the norm, said to be now 520/70 R38 (89). This has meant that, coupled with the trend to radial from cross ply tyres over recent years, the tonnage of tyres sold has increased even although in unit terms sales have decreased. Although radial tyres are making headway it is reported that in the USA the large farm tyre segment remains a bias stronghold (23).

There has been consolidation of tyre manufacturers and market is dominated by Pirelli, Goodyear and Michelin/Kleber. Consolidation is also expected in the agricultural tyre dealers because of increased call for very specialised service and bespoke tailoring of tyres to particular operations in the field that smaller dealers
cannot provide. The replacement tyre market is less dominated by the leaders and this is particularly so for the tyres for implements.

It is forecast (84) that, according to current trends, rubber tracks as opposed to tyres will be the choice for high powered agricultural tractors. The article considers the advantages and disadvantages of tracks and notes that dealers will need the expertise to advise on the alternative products.

Polymers are extensively used in dairy equipment including hoses, storage tanks and rubber liners.

High impact polypropylene is successfully used in lawn mowers, for example, as an under deck to improve grass collection and reduce noise (30).

Spraying equipment uses polypropylene tanks, rubber seals and many components are moulded plastics. Polymers are prevalent in tools; polypropylene has even replaced steel for the trays and wheels of some wheelbarrows with the obvious advantages of strength to weight ratio and no rusting.

A review of lawn and garden injection moulded products (194) noted that plastics were increasingly replacing metals in engines of garden machines and that polyamide was being used in handles.

10 Containers and Packaging

This section covers a wide and varied range of applications:

- Plant and seed containers
- Troughs, pans, and buckets
- Packaging for fertilisers and chemicals
- Packaging of food stuffs
- Tanks and pits

It is easy to forget that plastics produced a revolution in containers and packaging. The variety of materials and the ease of producing complicated shapes allowed a freedom in design and performance probably not even dreamed of previously. The revolution has applied in agriculture as much as in other areas.

Injection moulded and vacuum formed polypropylene plant pots come in a large range of sizes, are many times lighter than clay pots and have much more efficient drainage. Their low cost and convenience enabled the huge market that has developed for containerised plants that can be marketed and transported at any time of the year. Complementary to plastic pots are the carrying, shuttle and market tray systems for transporting and display, which through clever design have rigidity but low material usage. There are also specialised containers for the relatively new market of plug and baby plants by mail order. Simple seed trays have been augmented/ replaced with multi-cell plug trays and tray insert systems that cater for all possible plant raising needs. For the consumer market, plant containers are made in a variety of designs and sizes and have enabled container gardening for those with little space very cheaply. Specialist containers have been developed, for example strawberry towers, hanging baskets, pond planting baskets and even a polypropylene potato growing container.

Simple plastic buckets are used in most industries and galvanised steel has long since gone. The same applies to a variety of troughs, pans and drink and feed dispensers needed in animal husbandry. In domestic use, blow moulded polyolefin compost bins and water butts are popular, and watering cans are very widely found useful. Large carrying bags, variously of polypropylene or polyethylene, are used for horticultural rubbish such as hedge trimmings.

Polyethylene bags are universally used to package fertilisers, composts, soil improvers, lawn sand, etc., providing efficient handling with good protection at low cost. Additionally, there are the compost filled growbags used for tomatoes, cucumbers, etc., that offer a pest and disease free starting environment. All manner of chemicals come in plastic bottles and drums with sizes from 1 to 25 litres or more. Almost everything nowadays comes packaged, including the shrink wrapped film that encases the pallets of bags of potting or seed compost and the polystyrene foam that protects machinery parts or the farm computer during transit.

Perhaps not strictly part of the agriculture industry but certainly a result of it, the produce after any processing will in most cases be packaged when it goes to the retail market. Food packaging is now very sophisticated with multi-layer films developed with selective gas and moisture permeabilities to suit the requirements for preserving the particular product. Milk sold in shops and supermarkets is no longer in glass bottles and produce such as vegetable oils and fruit juices are usually in plastic bottles. Perhaps upsetting to the purist, plastics corks are used for
sealing wine bottles and it is demonstrated that screw
tops with a plastic element will be even more efficient.
As an indication of the care taken with packaging, a
trial found that polyethylene was the best option for
maintaining the taste and quality of Sweetheart
cherries (8).

Animal waste can be channelled from buildings and
contained in GRP tanks or polymer lined pits/ponds
constructed in the same manner as reservoirs.

Tanks 1.5 m wide, 0.7 m deep and between 3 and 9 m
long made of plastic fibre (possibly made of GRP?)
and lined with PVC can be used on fish farms (112),
one advantage over conventional installations being
the saving of space if the tanks are arranged in two or
three levels.

11 Miscellaneous Applications

This section serves as a vehicle to list applications
which for whatever reason have not fitted into other
categories.

11.1 Identification Tags

Animal identification tags are normally injection
mouldings used externally. A novel ‘moo-tag’ is fed
to cows and sits in the stomach as a permanent means
of electronic identification (85).

11.2 Clothing and Footwear

Fabrics and sheet materials used in work and
protective clothing are very often polymeric. This
includes polychloroprene aprons and nitrile gauntlets
for chemical resistance and polycarbonate face masks
and goggles. Wellington boots were originally natural
rubber but are now more likely to be PVC.

11.3 Controlled Release of Fertilisers, etc.

Controlled release technology has attracted a lot of
attention in recent years. There is a clear advantage if
one dose of a drug, fertiliser, pesticide, etc., can be
effective over a long time period without there being
an overdose at the beginning which trails off to
underdose. In horticulture, controlled release
fertilisers such as Sincrocell and Osmocote are
probably most widely known examples of the
technology, but it is also applied to pesticides,
pheromones and biomaterials.

A variety of polymers are used as the carrier for the
active ingredient, both natural and synthetic. A list of
those used to give controlled release of agricultural
fertilisers is given in (47). The method of holding the
active ingredient can be by physical coating/embedding
or by chemical combination with the
carrier. In the first case the coating membrane provides
barrier properties to control the release whilst in the
second there is a gradual breakdown of the chemical
linkage. A detailed review is given by Dave and Mehta
(129). They also give a list of some commercial
fertiliser products which does not include Sincrocell.
This product appears to be relatively new to the market
and is said to use an advanced polyurethane carrier.

The use of natural rubber and styrene-butadiene
rubber (SBR) as a carrier for slow release of a trace
element, zinc, was recently studied in detail and
demonstrated the effect of temperature and pH (32).
A nanoprecipitation technique for encapsulation of
an insecticide for cotton plants enhanced the
penetration of the insecticide but did not give
controlled release (9). Another approach is based on
the intercalation of polymers containing metribuzin
into montmorillonite (37). Polymeric formulations of
dichlorobenzaldehyde (DCBA) by modification of
both linear and crosslinked polyglycidyl methacrylate
have been studied for release of the DCBA as a
function of temperature and crosslinking (74).

11.4 Garden Ponds

Rigid ponds are constructed in quite large sizes from
GRP, and flexible liners are produced in PVC at the
cheaper end and EPDM and butyl rubber at the higher
quality end. The most recent material is a polypropylene
material called Xavan sold as Pondtex liner. It is made
of layers of filaments formed into a multidirectional
web and heat bonded at the crossover points. Pondtex
is said to be at least as strong as butyl rubber.

11.5 Greenhouse Sundries

These include foam sealing strip, climate screen
accessories such as clips and polyamide vent guides
and fan components.
11.6 Labels

It was interesting to see in one horticultural merchant’s catalogue a reference to ‘traditional plastic pot labels’. The market is now so mature that plastics are traditional. Computer generated labels are now used by most larger nurseries.

11.7 Seed Coatings

Encapsulation of seeds makes for easier and more accurate sowing. Treatment of seed with a polymer containing the hormone kinetin is said to result in significant increases in germination (58).

11.8 Soil Less Cultivation

Cultivation on inert natural or artificial substrates was developed in the 1970s and relies on plastics in the form of membranes, troughs, pipes and tanks, etc. True hydroponic systems are used on a relatively small scale but usage has doubled since 1991 (70).

11.9 Ties and Grafting Bands

A variety of ties are made from plastics and rubbers. Velcro tree ties are a newer introduction that can be cut off the roll and repositioned as the tree grows.

11.10 Twine

Despite having a one line entry under miscellaneous, the market for agricultural twine is very large as noted in Section 2.

11.11 Others

Other uses for plastics include: hanging basket liners, lawn edging strip, netting for plant support, polyamide monofilament for strimmers, sealing tape and pegs for fixing ground cover, plastic coated training wires and plant supports.

No doubt there are farmyard toys made of plastics, but if farmers want to go one better for their children there are miniature garden kits complete with automatic irrigation (118).

12 Standards and Testing

Standards have been established at national and international level for a number of polymer products for agricultural use, notably plastic films and pipe, in response to the need for consistent and adequate quality. The websites/catalogues of ISO, CEN and national standards bodies can be consulted for available documents. Spanish standards related to agriculture are examined by Ruiz (83). Generally, the test methods used to demonstrate quality and performance of polymers for agricultural use are the same as used for polymers in general (12, a.13) although there will be emphasis on particular properties and some special requirements.

In a discussion of applications of plastic film in agriculture (13), analytical methods for determination of the presence and compatibility of additives such as antioxidants and UV stabilisers are outlined together with factors affecting the stability of greenhouse films, from temperature to the effect of pesticides. The ageing resistance of films is also briefly considered.

For polyethylene film for greenhouse covering, there have been extensive studies of test methods to establish the European specification. Dilara and Briassoulis (154) gave a critical evaluation of existing test methods and suggested that additional methods were needed for the particular circumstances of this application. Later in the work, Briassoulis and Aristopoulou (42) gave a detailed account of the adaptation and harmonisation of test methods to be used in a specification for greenhouse films. In the measurement of basic mechanical properties a particular problem in determination of strain of the horticultural film was encountered using standard strain gauges (50) because of the low film thickness.

In comparison with many areas, the lifetime of agricultural products are at extremes. Underground piping is expected to have a working life of several decades whilst mulch film may last for only one season. Greenhouse cover film lasts only a few seasons, but more than earlier materials, and its resistance to UV light, temperature and chemicals is a very important factor.

In situ exposure of greenhouse films with continuous monitoring of the spectral absorption has been used to estimate lifetime and models fitted to allow prediction of deterioration at a given time (21). A method for evaluating polymer films for agricultural applications by optical characterisation is proposed and results for biodegradable materials compared to conventional films.
A test chamber has been constructed for testing the effect of agrochemicals on greenhouse film and demonstrated that sulfur vapour had a serious effect on condensation and mechanical properties in a matter of weeks (10).

A comprehensive study of ageing of polypropylene cords showed that chemicals such as pesticides and fungicides could practically neutralise the benefits of UV stabiliser (132), as noted for films in Section 13.

A method for checking on whether biomass from degraded materials has been bio-assimilated that should appeal to farmers, is to weigh at intervals a population of starved earthworms (22).

13 Disposal and Recycling

The quantity of polymer waste generated now gives rise to very serious environmental concerns. On quick reflection it is obvious that the great success of polymers in agriculture will mean an enormous amount of discarded material which contributes to this problem. The volume of fertiliser bags and used plant pots must be intimidating but would pale against the quantity of discarded mulching film and silage wrapping. An extremely attractive way to alleviate the problem is for much of the material to be environmentally degradable.

An overview of environmentally degradable polymeric materials in agricultural applications has been given by Chiellini and co-workers (27). Studies of photo/biodegradable films for mulching have been carried out in Taiwan (120). Not only the performance of films for the current crop, but also the effect on subsequent crops, including the presence of heavy metals, was considered.

What was claimed to be the first totally biodegradable polyethylene, known as Symphony, has been described (152). It is said that it can be engineered to degrade in as little as 60 days or as long as 5-6 years either in composting conditions or through photo and thermal degradation. At about the same time a family of totally degradable materials based on polyethylene was reported to have been successfully developed and commercialised (125). A comparison of the weathering of a degradable copolyester and HDPE films was carried out to see if the former could replace the latter (28).

Systematic collection of polymer waste is expensive and limited. Agricultural waste from mulch and crop cover film, irrigation tubes and packaging has an added problem of often being contaminated with soil and chemicals and has been categorised as ‘special waste’ in an European Community classification, which means it needs special treatment. Apart from alleviating the waste disposal problem there could be cost savings from avoiding the expense of removing and sorting the discarded products if they could be photo-thermally or biologically degraded.

The large amounts of film used with homogeneous composition should in principle make collection and recycling operations easy (13) but this is ignoring practical problems such as the contamination levels. Apparently, pesticide residues can reduce the efficiency of stabilisers with implications for the stability of the recycled product. Also, the film after use outdoors for long periods is in fact considerably degraded before recycling and is further degraded by the reprocessing. To alleviate this problem, trials were made by adding Irganox antioxidant during the reclamation (55) and it was concluded that it should be added at each step of the process. The levels of pesticides in waste film has been investigated (132). The reuse of recycled LDPE with the incorporation of EPDM modifier was investigated and the effect of natural weathering measured (34).

Initiatives for recycling include a partnership in Ontario, Canada between the Environmental and Plastics Industry Council, the Ontario Ministry of Agriculture and the Ontario Soil and Crop Improvement Association (62). The first phase of a Canadian project was reported as completed (75) and the next step was to pilot different methods of collection. Brief details are given of recycling projects in the UK for agricultural plastic waste; recycling in Wales, a composting plant near Bridlington and an incinerator in Huddersfield (126). The Cumbria Plastics Recycling Scheme (16) is an example of the sort of scheme that UK farmers will need to become familiar with when legislation on waste management is applied to agricultural waste in 2004. The scheme is supported by several very notable bodies and expects to recycle 600 tonnes of agricultural film this year.

An advanced methodology for recycling called Solid State Shear Pulverisation (46) does not need sorting of the waste film either by type or colour and is claimed to produce high quality blown film with particularly high elongation at break.

The complete cycle of reuse could come about from experiments to recycle waste cellulosic material from plants into electrospun nanofibres, one possible use of which could be mats for controlled release of fertilisers, pesticides, etc., (a.14).
Used tyres are now a large scale problem and much effort has been put into reclaiming, recycling and use as fuel. Agriculture is putting its minor, but nevertheless very significant, input to this problem. One slightly unusual way of recycling is to use the tyres as construction elements (a.15). They can be directly used to build bank protection, breakwaters and artificial reefs or compressed into baled blocks for bank protection or dam construction. One restriction is the release of heavy metals, but it would seem appropriate if tractor tyres could become the home of fish that are subsequently destined to be food.

A very novel use of recycled tyres is as a watering station for livestock (64).

### Additional References


a.2 CIPA-CIDAPA, http://www.plasticulture.com


a.4 W.J. Roberts, Plasticulture, 2001, 2, 120, 70.


a.8 Aqua Dam, http://www.aquadam.com


a.10 Agricultural Polymers International, http://www.agripol.co.uk


a.12 Eridan Co. Ltd., http://www.eridan-asia.com


### Abbreviations and Acronyms

CIPA International Committee for Plastics in Agriculture

DCBA dichlorobenzaldehyde

EPDM ethylene-propylene diene monomer

EVA ethyl vinyl acetate

GRP glass reinforced plastic

HDPE high density polyethylene

LDPE low density polyethylene

LLDPE linear low density polyethylene

PAR photosynthetically active region

PE polyethylene

PMMA polymethylmethacrylate

PP polypropylene

PVC polyvinyl chloride

SAN styrene-acrylonitrile

SBR styrene-butadiene rubber

UV ultraviolet
Scrap Tire News
17, No.10, Oct. 2003, p.6
NEW FAUX FINISHED RUBBERSTUFF MULCH LASTS A LIFETIME
A US scrap tyre recycler based in Florida, American Rubber Technologies, is launching a new, environmentally-friendly, colourful and permanent landscaping mulch, called “RubberStuff”. It looks just like painted wood chips, but is reported to function far better. This small item informs us briefly of its advantages.
AMERICAN RUBBER TECHNOLOGIES INC.; US, ENVIRONMENTAL PROTECTION AGENCY USA
Accession no.901561

Macromolecular Symposia
No. 197, 2003, p. 443-53
ADDITIVES FOR CONTROLLED DEGRADATION OF AGRICULTURAL PLASTICS, ENVIROCARE
Bonora M; De Corte D
Ciba Specialty Chemicals SpA; Ciba Specialty Chemicals
Details are given of ENVIROCARE additives for conventional thermoplastics to obtain degradable agricultural plastic articles. Environcare products induce plastic degradation following a two-step mechanism. The plastic is first photo- and thermo-oxidised during the outdoor exposure. Once the degradation is activated the additive acts be increasing the degradation rate until the article is totally degraded. 8 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; SWITZERLAND; WESTERN EUROPE
Accession no.897913

Macromolecular Symposia
No. 197, 2003, p. 397-409
STRATEGIES FOR DETECTING ECOTOXICOLOGICAL EFFECTS OF BIODEGRADABLE POLYMERS IN AGRICULTURAL APPLICATIONS
Fritz J; Sandhofer M; Stacher C; Braun R IFA TULLN
Methods for determining biodegradability and material disintegration are discussed. An analysis of ecotoxic effects caused by biodegradable materials is examined. Theory, background data from method development and some results are presented for polyesteramide, starch, PE, polyhydroxybutyrate and polycaprolactone. 18 refs.
AUSTRIA; EUROPEAN UNION; WESTERN EUROPE
Accession no.897909

Journal of Plastic Film and Sheeting
18, No. 4, Oct. 2002, p.269-77
AGRICULTURAL FILMS: TYPES AND APPLICATIONS
Laverde G Battenfeld Gloucester Engineering Co.
The particular specifications and demands required by polyolefin films, particularly PE films, for agricultural applications are reviewed. Applications considered include greenhouse coverings, tunnels, mulches, soil sterilisation and fumigation applications, packaging and reservoirs.
USA
Accession no.896200

Plastics Additives and Compounding
5, No. 4, July-Aug. 2003, p.20-3
STABILIZING AGRICULTURAL FILMS: A QUESTION OF BALANCE
Simpson K
UV stabilisers are essential for protecting agricultural films from degradation, but balancing UV stabilisation with other properties such as chemical resistance is a challenge. The main UV stabiliser packages currently used in agricultural films are UV absorbers (UVA), nickel quenchers (NiQ), hindered amine light stabilisers (HALS) and aminoxyamine hindered amine light stabilisers (NOR-HALS). The main advantage of UVA/NiQ combinations is an extreme resistance to pesticides. The drawbacks of nickel quenchers is that they contain heavy metals and are always green in colour, which reduces light transmission, and high melting point. One company developing NiQ products with the aim of overcoming some of these problems is Great Lakes Chemical. NOR-HALS have a very low basicity to limit their interaction with acid chemicals, but these products are more expensive.
WORLD
Accession no.894295

Journal of Polymers and the Environment
11, No. 3, July 2003, p.101-5
EFFECT OF POLY(L-LACTIDE) AND POLY(BUTYLENE SUCCINATE) ON THE GROWTH OF RED PEPPER AND TOMATO
Kim M-N; Shin J-H; Im S-S Sangmyung, University; Hanyang, University
Pellets of biodegradable poly(L-lactide) and polybutylene succinate were cryogenically ground and the resulting powders mixed with arable soil. Seeds of red pepper and tomato were grown in this soil and the effect of the
biodegradable polymers on the growth of the plants investigated. Polybutylene succinate markedly retarded the growth of the plants whereas poly(L-lactide) in an amount of up to 35% had a negligible effect on the plants and even boosted their growth. 13 refs.

KOREA
Accession no.894056

Item 7
Asian Plastics News
July-Aug.2003, p.24
Chinese; English
NEW CABOT PRODUCTS FOR THE AGRICULTURE INDUSTRY
It is briefly reported that Cabot has added three new grades to its Plasadd range of anti-UV masterbatches for greenhouse film and mini-tunnel film that come into contact with agrochemicals. Designed to improve UV resistance, PE8740 is recommended for use in greenhouse and tunnel film applications that require excellent chemical resistance and also in critical mulch film applications. Nickel-free non-interacting HALS together with a UV absorber gives it superior resistance to agrochemicals, including burnt sulphur.

CABOT CORP.
USA
Accession no.892399

Item 8
European Plastics News
30, No.6, July-Aug.2003, p.34
CHERRIES TASTE BETTER IN LDPE
It is briefly reported that researchers in Argentina have found that LDPE film is the best option for maintaining the taste and quality of cherries. The “sensorial” quality of Sweetheart cherries stored in modified atmospheres at 0°C for 35 days in several types of bags was studied. The bags were made from LDPE, PVC and an unnamed commercial plastic film.

ARGENTINA,INSTITUTO NACIONAL DE TECNOLOGIA AGROPECUARIA ARGENTINA
Accession no.892234

Item 9
Journal of Microencapsulation
20, No.4, July-Aug.2003, p.433-41
NANOPRECIPITATION TECHNIQUE FOR THE ENCAPSULATION OF AGROCHEMICAL ACTIVE INGREDIENTS
Boehm A L; Martinon I; Zerrouk R; Rump E; Fessi H Laboratoire de Pharmacie Galenique; Aventis CropScience Ltd.
The ability of various polymeric nanospheres to improve the biodelivery of a new insecticide (RPA 107382) to cotton plants infested with aphids was investigated. Of the polymers investigated, Eudragit S100 NS prepared by the nanoprecipitation technique was chosen for further biological studies due to its small particle size and higher encapsulation rate. The nanospheres enhanced the penetration of insecticide into the plants, as compared with a classical suspension, but did not provide controlled release of the insecticide. 34 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE
Accession no.891541

Item 10
Polymer Degradation and Stability
80, No.3, 2003, p.575-8
INFLUENCE OF AGROCHEMICALS ON GREENHOUSE CLADDING MATERIALS
Geoola F; Kashi Y; Levi A; Brickman R Israel,Institute of Agricultural Engineering
A test chamber was designed and constructed for study of the effect of agrochemicals (sulphur vapour) on the condensation and mechanical properties of greenhouse cladding materials. The roof of the test chamber was covered by three types of LDPE films (UV stabilised, UV and IR modified, and UV stabilised, IR modified and anti-droplet). The exterior surfaces of the films were exposed to sun, while the interior surfaces were exposed to sulphur vapour as used in rose greenhouses. At times of 3, 6, 9 and 12 weeks from the start of the experiments, samples of the films were tested for EB and anti-droplet properties. After 3 weeks of sulphur evaporation, the anti-droplet plastics films had lost their anti-droplet properties. After 12 weeks of sulphur evaporation, the EB of the films was reduced to about 35% of its original value. 9 refs.

ISRAEL
Accession no.891244

Item 11
Brookfield, CT, SPE, 2003, p.415-9, 27cm, 012
INVESTIGATION OF THE FEASIBILITY OF THE APPLICATION OF POLYMER TO FACILITATE THE GROWTH OF PLANTS IN ARID LANDS
Tabrizi M; Alaimo M; Javadi L Wisconsin-Platteville,University; Flambeau Corp.; Tehran,Bahashty University (SPE,Environmental Div.)
The primary concern in this study was to utilise polymeric materials to facilitate the availability of water for plant growth, specifically in remote areas where dropped water is not common and irrigation
systems are non-existent or impractical to implement. The first phase of this project is to identify whether a polymer can be synthesized to encourage precipitation of the moisture in the air. A number of polymers absorb a substantial volume of water through crystallisation. The water absorption combined with the polymers’ ability for condensation potentially can offer a substantial amount of water to be used for growing seed or plant root.

USA

Accession no.886096

**Item 12**
Handbook of Plastic Films.
Shawbury, Rapra Technology Ltd., 2003, p.329-56, 25 cm. 625

**TESTING OF PLASTIC FILMS**
Abdel-Bary E M; Akovali G
Edited by: Abdel-Bary E M
(Rapra Technology Ltd.)
A comprehensive review is presented of test methods for plastic films. Included are details of mechanical tests, physical, chemical and physicochemical tests. The requirements for test methods, and interpretation of test results are also discussed. 72 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE

Accession no.885607

**Item 13**
Handbook of Plastic Films.
Shawbury, Rapra Technology Ltd., 2003, p.263-284, 25 cm. 625

**APPLICATIONS OF PLASTIC FILMS IN AGRICULTURE**
Abdel-Bary E M; Yehia A A; Mansour A A
Edited by: Abdel-Bary E M
(Rapra Technology Ltd.)
Low-density PE and ethylene-vinyl acetate and linear low-density polyethylene films are the most common greenhouse covering films used in agriculture. This chapter examines the production of PE-based plastic films for protected cultivation, and the mechanical properties that make these films suitable for use in agriculture, are discussed. In addition, the stability of these plastic films is reported under the effects of different environmental conditions. These include solar irradiation, temperature, humidity, wind, fog formation, and pesticides. Types of UV stabilisers are described, and details of their compatibility are given. The recycling of plastic films used in agriculture is also addressed, and a case study of their recycling as agricultural films is included. 62 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE; WORLD

Accession no.885605

**Item 14**
*Journal of Applied Polymer Science*
87, No.14, 1st April 2003, p.2365-71

**NATURAL WEATHERING, ARTIFICIAL PHOTO-OXIDATION, AND THERMAL AGING OF LOW DENSITY POLYETHYLENE: GRAFTING OF ACRYLIC ACID ONTO AGED POLYETHYLENE FILMS**
El-Awady M M
Egypt,National Research Centre
The photooxidation and thermally-initiated changes of commercial LDPE films used in greenhouse covering, in the presence or absence of UV stabiliser, were monitored by IR spectroscopy, by mechanical tests and by examining the grafting of acrylic acid onto the aged films. The UV resistance and thermal stability of the films, as evidenced by TS and EB, were greater for stabilised PE films than for un unstabilised ones. A simple correlation was not observed between the decrease in mechanical properties and the rate of film oxidation. An almost linear relation was, however, observed between the level of PE oxidation measured by IR spectroscopy and the degree of grafting. 22 refs.

EGYPT

Accession no.883269

**Item 15**
*European Plastics News*
30, No.2, March 2003, p.23-4

**BIG IN FILMS**
Comini A
Pati, an Italian processor of blown films, designs its agricultural products for use with a variety of plants and for a range of climates. Although the well-established EVA-based film for greenhouses, sold under the Patilux brand name, still accounts for more than 25% of annual sales, new products are meeting with good appreciation worldwide. The Patilite range features thousands of expanded microbubbles within the film structure. This provides unprecedented control of the greenhouse’s internal temperature by limiting the penetration of short infrared rays (those responsible for heat increase) during the day and by preventing heat dissipation during the night. New EVA-based Clarix films are produced with different colour filters, enabling the most appropriate light selection for the plant’s needs. Pati is also involved in a European project aimed at developing new mulching and greenhouse films using biodegradable plastics.

PATI SPA
EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY;
WESTERN EUROPE

Accession no.881589

**Item 16**
*Materials Recycling Week*
181, No.7, 21st Feb.2003, p.15

**BUMPER YEAR FOR PLASTIC HARVEST**
Thyer R

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The Cumbria Plastics Recycling Scheme, which collects plastics farm film, including bale stretch wrap, silage sheet, small feed/fertiliser/mineral bags and fertiliser bag liners, is described and highlighted as a recycling scheme that farmers will need to become familiar with when legislation on waste management is applied to waste agricultural film in 2004. The Scheme is supported by South Lakeland District Council, National Trust, Landfill Tax Credit Scheme, Lake District National Park Authority and Environmental Agency and is planning to recycle 600 tonnes of agricultural film this year.

UK, SOUTH LAKELAND DISTRICT COUNCIL; NATIONAL TRUST (ENTERPRISES) LTD.; UK, LAKE DISTRICT NATIONAL PARK AUTHORITY; UK, ENVIRONMENTAL AGENCY
EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.880046

Item 17
International Polymer Science and Technology
29, No.11, 2002, p.7/54-8
LUMINESCENT PROPERTIES OF POLYETHYLENE FILMS WITH THE ADDITION OF PHOTOLUMINOPHORES BASED ON EUROPIUM COMPOUNDS
Raida V S; Koval’ E O; Ivanitskii A E; Andrienko O S; Tolstikov G A
Russian Academy of Sciences
LDPE film, used for agricultural applications such as covering greenhouses or crops, when containing additions of photoluminophores based on europium compounds, has been found to promote accelerated growth and increased yield of crops. The effect of films on the physiology of plants has been termed the ‘polisvetan’ effect, and is currently attributed to light correction, i.e. a change by the films of the spectrum of electromagnetic solar radiation through the absorption of the shortwave component and the transformation of absorbed energy into the red region of the spectrum. This article studies the luminescent properties of light-correcting PE films, which are most important from the viewpoint of their practical application as coatings of covered-ground structures in agriculture. 10 refs. (Article translated from Plasticheskie Massy, No.12, 2001, p.38-40).
RUSSIA
Accession no.879469

Item 18
Plastics Additives and Compounding
5, No.1, Jan.-Feb.2003, p.12
RED LUMINESCENT ADDITIVE BENEFITS AGRICULTURAL COVERS
A new photoselective additive, called Ciba Smartlight RL 1000, has been launched by Ciba Specialty Chemicals for plastic agricultural covers. It shifts light from the UV part of the spectrum to visible light used by crops for photosynthesis and is claimed to improve crop quality and productivity. It has also been announced by Ciba Specialty Chemicals that Food Contact Notification has become effective for its Irgaguard B 5000 silver-based inorganic microbial.
CIBA SPECIALTY CHEMICALS
USA
Accession no.878435

Item 19
Plast’ 21
No.110, April 2002, p.40-4
Spanish
THERMAL GREENHOUSE COVERING FILMS WITH TAILORED LIGHT DIFFUSION
Espí E; Salmerón A
Repsol-YPF
Requirements for IR opacity and visible light transmission in plastics greenhouse covering films are examined, and the modification of these properties in LDPE and EVA films through the incorporation of mineral fillers is discussed. 26 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE
Accession no.878042

Item 20
Plast’ 21
No.110, April 2002, p.36-8
Spanish
PLASTICULTURE IN SPAIN
Bautista A L
Cicloplast SA
Applications of plastics in agriculture and horticulture in Spain are examined, with particular reference to greenhouses, cloches and mulches. Statistics are presented for areas of land covered by plastics and for overall consumption of plastics in agricultural and horticultural applications. Developments in the recycling and disposal of plastics waste from these sectors are reviewed, and production capacity figures are given for some leading companies involved in the mechanical recycling of agricultural waste.
CICLOAGRO; EGMASA; ALFAGRAN; IBACPLAST SL; RECICLADOS LA RED; RECICLADOS NIJAR SL
EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE
Accession no.878041

Item 21
Revista de Plásticos Modernos
Spanish
MODELLING THE NATURAL AGEING PROCESS OF THREE POLYETHYLENE FILMS USED AS GREENHOUSE COVERINGS IN
Natural ageing tests were conducted on three PE films of different colour and thickness mounted on a greenhouse in Almeria, Spain. Photosynthetically active and global radiation were continuously monitored both inside and outside the greenhouse over three seasons. The radiation absorption of the films increased considerably in the second year of use, leading to the assessment of their service life at two years. Mathematical models were developed on the basis of the least squares method to fit the results, and these allowed prediction of the degree of deterioration of films at a given time and provided guidelines for the replacement of greenhouse coverings. 11 refs.

DEGRADABLE POLYMERS IN A LIVING ENVIRONMENT: WHERE DO YOU END UP?
Vert M; Santos I D; Ponsart S; Alauzet N; Morgat J-L; Coudane J; Garreau H
Centre National de la Recherche Scientifique
An increasing environmental difficulty is the resistance of synthetic polymers to biodegradation, particularly where they are used for a limited period of time before becoming waste. As well as in the environment, agriculture, pharmacology, and surgery all experience the same problem. Time-resistant polymeric wastes are less and less acceptable for applications such as bone fracture fixation devices, sutures, packaging, and mulch films. Such applications should be eliminated after use. A potential solution is post-use biorecycling and simple and versatile techniques are presented for investigating the fate, and particularly the bioassimilation, of the degradation byproducts of degradable or biodegradable polymers in complex living media such as the human body, a compost or the general environment. Two techniques are discussed, involving radio labelled degradable and biodegradable artificial aliphatic polyesters by substituting some protons by tritium atoms. It is demonstrated that weighing a population of starved earthworms, allowed to be in contact with degradable and biodegradable polymer, is an appropriate technique for demonstrating that degradation byproducts are bioassimilated. 14 refs.

LIGHT STABILISING ADDITIVES FOR AGRICULTURAL FILMS. INTERACTION WITH PESTICIDES
Catalina F; Salmeron A; Garcia Y; Espi E
Instituto de Ciencia y Tecnologia de Polimeros; Repsol-YPF
A review is presented of the types of additives used for the light stabilisation of plastics films for mulching, cloches and greenhouse covering. Consideration is given to problems caused by the interaction of these additives with acid species resulting from the decomposition of pesticides, and some developments in stabilisers designed to overcome such problems are reviewed. 17 refs.

STILL BIASED AFTER ALL THESE YEARS
Manges M
In the USA agricultural tyre market, radial tyres are making headway, but it is reported that the large farm tyre segment remains a bias stronghold. This detailed article examines the current situation, as well as highlighting the benefits of bias tyres and also popular farm applications.

SPECK SALES INC.; TANDEM TIRE & AUTO SERVICE; GOODYEAR TIRE & RUBBER CO.; GRAHAM TIRE CO.; TITAN TIRE CORP.; FIRESTONE AGRICULTURAL TIRE CO.; ANDERSON F.; TIRE CO.; TRELLEBORG WHEEL SYSTEMS
EUROPE-GENERAL; NORTH AMERICA; USA
Accession no.875100
Item 26
*Revista de Plásticos Modernos*
83, No.547, Jan.2002, p.50-6
Spanish
**INTERFERENCE PIGMENTS AS MODIFIERS OF THE SPECTRAL TRANSMISSION OF AGRICULTURAL FILMS**
Espi E; Salmeron A; Garcia Y; Catalina F
Repsol-YPF; Instituto de Ciencia y Tecnología de Polímeros

The use of interference pigments consisting of mica coated with metal oxides for modifying the transmission of radiation by plastics films is discussed. Results are presented of studies carried out on LDPE greenhouse covering films containing such pigments. 8 refs.

MERCK; ENGELHARD CORP.
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; SPAIN; USA; WESTERN EUROPE
Accession no.871060

Item 27
*Polimery*
47, No.7-8, 2002, p.538-44
**ENVIRONMENTALLY DEGRADABLE POLYMERIC MATERIALS (EDPM) IN AGRICULTURAL APPLICATIONS - AN OVERVIEW**
Chiellini E; Cinelli P; D’Antone S; Ilieva V I
Pisa,University

An overview is presented of the history and recent developments in biodegradable polymeric materials used in agricultural applications, particularly in mulching. Particular attention is paid to a material based on renewable resources or utilisation of waste products from the agroindustrial sector, thus suggesting cost-effective and environmentally sound solutions to specific social needs. 74 refs. (UNIDO Workshop on Environmentally Degradable Plastics, Lodz-Pabianice, 2001)

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE
Accession no.871140

Item 28
*Journal of Polymers and the Environment*
9, No.2, April 2001, p.57-62
**OUTDOOR WEATHERING EVALUATION OF CARBON-BLACK-FILLED, BIODEGRADABLE COPOLYESTER AS SUBSTITUTE FOR TRADITIONALLY USED, CARBON-BLACK-FILLED, NONBIODEGRADABLE, HIGH-DENSITY POLYETHYLENE MULCH FILMS**
Tocchetto R S; Benson R S; Dever M
Tennessee,University

Mulch films of a carbon black-filled, biodegradable copolyester (Eastar) and a carbon black-filled HDPE were exposed to commercial vegetable crop growing conditions for a period of 12 weeks and on a plywood rack for 8 weeks. The tensile strength and elongation at break of the samples were measured every other week for 12 weeks and the data obtained from the weathering studies on both materials compared. The effect of meteorological variables on mechanical properties were evaluated and the feasibility of using the copolyester film as a substitute for the HDPE film assessed. 21 refs.

USA
Accession no.868951

Item 29
*Journal of Applied Polymer Science*
**PREPARATION, PHYSICO-CHEMICAL CHARACTERIZATION, AND OPTICAL ANALYSIS OF POLYVINYL ALCOHOL-BASED FILMS SUITABLE FOR PROTECTED CULTIVATION**
De Prisco N; Immirzi B; Malinconico M; Mormile P; Petti L; Gatta G
Istituto Di Ricerca e Tecnologia Delle Materie Plastiche; Basilicata,University; Italy,National Research Council

A subject of considerable interest from the environmental perspective is the use of biodegradable films for mulching. This is also of interest in terms of the intrinsic properties that such films might have when appropriately designed. Starting with existing biodegradable polymers, a synthetic approach has been developed that leads to a new material characterised by a time-controlled biodegradation. The concept was to bridge polyvinyl alcohol (PVOH) chains through polycaprolactone (PC) crosslinks. In this manner, PVOH loses its water sensitivity and can stand on the ground for the time required for mulching to occur, while the PCL crosslinks, being sensitive to a slow fungal attack, will undergo cleavage, followed by the complete bio-assimilation of the residual PVOH chains. Time of biodegradation can be controlled by the number of crosslinks introduced. The polymers were characterised for their intrinsic chemical-physical properties, while a preliminary evaluation of their efficiency as mulches was achieved through the analysis of their thermal behaviour when deposited on an irrigated soil. The results were compared with a model approach capable of predicting the thermal behaviour of a film in particular environments. 13 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE
Accession no.868951

Item 30
*European Plastics News*
29, No.9, Oct.2002, p.20-1
**MAKING THE GRASS GREENER**
Reade L
A new and critical part in Hayter’s redesigned lawnmower is the underdeck, a three-piece component made from high impact ABS. The helix-shaped part sits underneath the aluminium shell, enhancing the mower’s grass-collecting ability and reducing the noise generated by the blade. Ninefields injection moulds the components on Negri Bossi machines. CAD software, in the form of VX’s VX Overdrive, played an important role in the redesign.

HAYTER LTD; NINEFIELDS MOULD & TOOL CO.LTD; VX CORP.
EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE

Accession no.868155

Item 31
Atlanta, Ga., TAPPI Press, 2001, Session 22, Paper 1, pp.11, CD-ROM, 012
PROVIDING NEW EFFECTS AND VALUE FOR PLASTICS - FUNCTIONALIZATION OF FILMS THROUGH THE USE OF ADDITIVES
Horsey D; Lelli N
Ciba Specialty Chemicals
(TAPPI)
Some of the new and emerging technical effects that can be achieved by the use of additives in polyolefin films for the agricultural and packaging markets are discussed. Particular attention is paid to the use of antifogging agents to provide better light transmission and prevent crop damage, to providing plants with the wavelengths of light they need, to additives for getting rid of plants not required (e.g. anti-algal and anti-bacterial additives), to stabilisation of plastics and to making plastics degradable. Active food packaging materials with oxygen absorbers are also mentioned. 4 refs.
USA
Accession no.866107

Item 32
Polymer Testing
21, No.8, 2002, p.867-75
SLOW RELEASE RUBBER FORMULATIONS CONTAINING ZNSO4
Helaly F M; Nashar D E E
Egypt,National Research Centre
The performance of NR and SBR as binding matrices for zinc sulphate fertiliser was studied. The leaching rate of zinc in an aqueous medium was found to depend on the concentration of zinc sulphate loaded in the two types of rubber used, the temperature of the environment and the pH of the aqueous medium. Water uptake was increased with increasing concentration of zinc sulphate. The sustained release of zinc ions from the formulations studied was prolonged for over five months. The mechanical properties of the vulcanisates were affected by variation in the concentration of zinc sulphate, decreasing at high loading (70 phr) of zinc sulphate. 14 refs.
EGYPT
Accession no.865945

Item 33
Atlanta, Ga., TAPPI Press, 2001, Session 3, Paper 3, pp.6, CD-ROM, 012
NEW POSSIBILITIES ON GREENHOUSE FILMS WITH THE USE OF COEXTRUSION STRUCTURES
Trujillo A M; Carlos J; Garcia J
Repsol-YPF (TAPPI)
There has been an increase in controlled greenhouse cultivation due to increases in world population. New compounds have been produced based on LDPE and EVA for use in greenhouse covers. By using these compounds, combined in three layer structures, it is possible to select the degree of visible light transmission, direct or diffused light, thermal effect, UV blocking and antidripping effects. The films are formed using coextrusion technology. 16 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE
Accession no.864587

Item 34
Journal of Polymers and the Environment
9, No.1, Jan.2001, p.25-30
LDPE/EPDM MULTILAYER FILMS CONTAINING RECYCLED LDPE FOR GREENHOUSE APPLICATIONS
Amin A-R
Jordan,Applied Science University
The reuse of recycled LDPE in combination with the incorporation of EPDM modifier in the production of greenhouse films was investigated. The effect of natural weathering on the film properties over a period of 15 months was observed. Changes in physical and mechanical properties were determined. 17 refs.
JORDAN
Accession no.864034

Item 35
Plastics Additives and Compounding
4, No.7-8, July-Aug.2002, p.20-1
MASTERBATCHES SHOW WAY FORWARD TO AGRICULTURAL FILMS
Italian masterbatch manufacturer Vibagroup has introduced a number of new formulations to address specific problems in the agricultural industry with greenhouse films. The new masterbatches use hindered
amine light stabilisers with low PK values. The lower this value, then the less the HALS reacts with acid substances formed by the use of pesticides employed in agriculture. Two new masterbatches have been formulated which contain additives that are able to absorb harmful UV radiation and transform the absorbed energy by re-emitting it as red light. As vegetables require red light for their growth, increasing the quantity of this radiation will have beneficial effects. Antivirus, antifog and antimist, and IR absorption masterbatches are also discussed.

VIBAGROUP
EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE
Accession no.862696

Item 36
Materials World
10, No.8, Aug.2002, p.17
POLYMER PROMOTES GREEN SHOOTS ON OLD MINE SITES

The help nature recover from the impact of the mining industry, researchers from the Russian Academy of Sciences have developed a method that uses a thin polymeric film to stabilise freshly-seeded soil. The polymeric covering, Biorekulat, is a durable plastic film that is formed after applying an aqueous emulsion of polymer to the soil surface. The film effectively stabilises the surface by gluing the small soil particles together, ensuring that the topsoil stays in place. The polymeric covering is porous and air- and water-permeable. The film, which poses no barrier to the young plants as they are easily able to grow through it, stays in place for several years before biodegrading.

RUSSIAN ACADEMY OF SCIENCES
RUSSIA
Accession no.862629

Item 37
Journal of Polymer Science: Polymer Chemistry Edition
CONTROLLED RELEASE SYSTEMS BASED ON THE INTERCALATION OF POLYMERIC METRIBUZIN ONTO MONTMORILLONITE
Rehab A; Akelah A; El-Gamal M M
Tanta,University

A number of polymer/clay composites with metribuzin as herbicide moieties, and linear copolymers containing metribuzin via an imide linkage were obtained by free radical polymerisation of metribuzin monomer (N,N-diacrylol metribuzin) with various comonomers. Intercalation of the copolymers onto montmorillonite by cationic exchange gave metribuzin composites. The materials obtained were characterised by GPC, NMR, IR, elemental microanalysis, gravimetric analysis, and swelling measurements. The release rates of the materials obtained were studied in media of different pH using an ultraviolet spectrophotometer. The compounds were also tested with a view to herbal growth control. 27 refs.
EGYPT
Accession no.862600

Item 38
Journal of Materials Science
37, No.14, 15th July 2002, p.3067-74
COMBINED EFFECT OF FIBER CONTENT AND MICROSTRUCTURE ON THE FRACTURE TOUGHNESS OF SGF AND SCF REINFORCED POLYPROPYLENE COMPOSITES
Fu S-Y; Mai Y-W; Lauke B; Xu G; Yue C-Y
Sydney,University; Hong Kong,City University; Dresden,Institute of Polymer Research; California,University; Nanyang,Technological University

Composites of PP reinforced with short glass fibres and short carbon fibres were produced by extrusion in a twin-screw extruder and injection moulding and their fracture behaviour investigated. Measurements were made of the fracture toughness of compact tension specimens in the main crack transverse to the mould flow direction and in the main crack parallel to the mould flow direction. The combined effect of fibre volume fraction and microstructure on the fracture toughness of the composites was examined and fibre pull-out at the fracture surfaces of composites with different fibre volume fractions, as determined by scanning electron microscopy, compared. 23 refs.
AUSTRALIA; CHINA; EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; HONG KONG; SINGAPORE; USA; WESTERN EUROPE
Accession no.862472

Item 39
Plasticulture
3, No.121, 2002, p.118
English; French; Spanish
SHADE NETTING AND POLYTHENE COVERS

A careful study of agricultural problems has allowed Novatex to develop a range of shade netting and shade fabrics in 100% PE and UV stabilised. The systematic use of these products in greenhouses and tunnels has been particularly revealing in flower, fruit production and horticulture. It permits an efficient forcing for plants where it is necessary to obtain particular and different environmental conditions according to the type of plant. A wide range of colours and covers allow specific solutions with a great deal of professionalism to be obtained. As well as being manufactured in a great variety of colours, Novatex offers various degrees of covering (from 30-90%), allowing these shades to be adapted to any type of cultivation and customer requirement. There are many advantages for this product. Its strength and its
notable anti-ravelling properties guarantee a long life. It is also possible to cut and divide it without the need to add edgings. The company treats the shades in a particular way to make them rot proof and stops them from housing insects. This abstract includes all the information contained in the original article.

NOVATEX SPA
EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE
Accession no.860457

Item 40
Plasticulture
3, No.121, 2002, p.96-107
English; French; Spanish
DEVELOPMENTS IN LATIN AMERICA
PLASTICULTURE
Pacheco M M

The Iberoamerican economy - defining Iberoamerica as the countries of the American continent culturally identifiable with either Portugal or Spain - is mostly based on agriculture. Traditional horticulture has long roots there. Corn, potatoes and tomatoes are pre-columbian crops, and flowers had great social and religious importance among the ancient Aztecs. It is not surprising, then, that a high degree of acceptance has been found for modern horticultural technology in some of those countries and that also some of them are even making contributions to its development. Plasticulture is one of the main technological areas where Iberoamerican countries are rapidly adopting or even taking the lead in innovation. In the III CIDAPA Congress, which took place in Valencia (Spain) in October 2001, Iberoamerican scientists and technicians reported on the situation in their countries.

EUROPEAN COMMUNITY; EUROPEAN UNION; LATIN AMERICA; SPAIN; WESTERN EUROPE
Accession no.860455

Item 41
Plasticulture
3, No.121, 2002, p.72-89
English; French; Spanish
PLASTICS AND THE STORAGE OF FODDER AND GRAIN IN THE REPUBLIC OF ARGENTINA
Carluccio J C; Bragachini M; Martinez E G
Carluccio & Associates srl; INTA Manfredi; Plasta San Luis SA

Cattle and grain production are the main agricultural activities in Argentina. With 50 million heads roaming the countryside, forage conservation is one of the most important technologies for cattle raisers. Plastics have always been used to this end, but from 1994/95 onwards a real revolution has commenced in these applications. In 1999 plastics also started to be used for the conservation of grain crops. These developments and the characteristics of the plastics utilised are examined. 16 refs.

ARGENTINA
Accession no.860453

Item 42
Plasticulture
3, No.121, 2002, p.48-71
English; French; Spanish
PLASTICS IN THE DISINFECTION OF AGRICULTURAL LAND
Marquina J T; Bello Y A
Almeria,Universidad; Madrid,Centro de Ciencias Medioambientales

Soil disinfection has always been approached as a necessity in order to reduce losses caused by the parasites referred to as soilborne parasites. They cause serious disorders or pests: the death of seedlings, the failure of seeds to sprout, root rot, vascular disorders, pests like the flathead borer or wireworm, etc. This application has been extended because some disinfection techniques increase final yield and are also effective herbicides against weeds such as sedge. For these reasons disinfection of the soil or substrate has been incorporated as a practice in intensive crop growing, under plastic. The use of methyl bromide and solarisation have been the traditional plastic-consuming techniques in disinfection procedures. The need to eliminate methyl bromide by 2015 has led to a series of alternatives for disinfection, in which plastics play an important role. Thus, the use of metam sodium, biofumigation, mixing dichloropropene with chloropicrin, phormol, are more effective with plastic-based coverings. 21 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE
Accession no.860452

Item 43
Plasticulture
3, No.121, 2002, p.36-46
English; French; Spanish
EFFECT OF COLOURED MULCH ON PRODUCTION AND THRIPS CONTROL WITH LEEK
Benoit F; Ceustermans N
European Vegetable R & D Centre

Under Belgian climatic conditions, the development of leek plants is not influenced by mulching during the first four to six weeks after planting (end of June). From August to October, 75% of the weight increase takes place and is on average 10% higher on mulched plots. Until mid-November, the plant weight keeps rising to a limited extent on the mulched plots while it stagnates from October onwards on uncovered soil. The variations in weight are correlated to the increase in the diameter of the white shaft. The favourable effects of the white soil mulch are...
ascribed to the more regular growth rate of the stem part as a result of the lower soil moisture tensions and the more equable temperatures measured under the white plastic and the higher light reflection over the mulch. With plants on white, yellow and blue mulch, spread with glue, a lower incidence of thrips is noted. As well as the above advantages, the reduction of nitrate washing out, the preservation of leaf wax coating and the suppression of weed development should also be stressed as ecological achievements of soil cover. 15 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE
Accession no.860451

Item 44
Plasticulture
3, No.121, 2002, p.22-35
English; French; Spanish

RADIOACTIVE AND CONVECTIVE HETEROGENEITY IN A PLASTIC TUNNEL: CONSEQUENCES ON CROP TRANSPIRATION
Boulard T; Wang S
INRA

The airflow pattern and the climate heterogeneity in a plastic tunnel are investigated, and the heterogeneity of crop transpiration is deduced. The solar radiation distribution within the greenhouse tunnel is simulated, and also airflow patterns, temperature, humidity and crop transpiration. Crop transpiration strongly varies (up to 30%) according to the place in the tunnel. Predicted crop transpiration is in good agreement with the measured values. 15 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE
Accession no.859618

Item 45
Scrap Tire News
16, No.7, July 2002, p.6

NO MORE RE-MULCHING
American Rubber Technologies Inc. has developed a colourful and permanent rubber mulch, called RubberStuff, from recycled tyres as a replacement for wood mulches.

AMERICAN RUBBER TECHNOLOGIES INC.
USA
Accession no.860333

Item 46
Brookfield, CT, SPE, Paper 34, p.293-300, CD-ROM, 012

RECYCLING OF POST-CONSUMER AGRICULTURAL FILM VIA SOLID-STATE SHEAR PULVERISATION PROCESS (S3P)
Khait K; Riddick G E
Northwestern University (SPE,Environmental Div.)

Despite legislative pressures to recycle plastics, difficulties associated with resin grade and colour variations, the presence of contaminants, have slowed down the market for recycling agricultural films. These films are predominantly PE (86%). Details are given of an advanced technology called Solid-State Shear Pulverisation (S3P). The novel process, developed by the Polymer Technology Center at Northwestern University does not require sorting of the agricultural films either by type or colour. The process uses a twin-screw pulveriser with extensive cooling, and is governed by mechanochemistry where the use of mechanical energy causes a chemical reaction in mixed polymers. Films made using S3P technology are reported to exhibit exceptionally high elongation at break, and good processability by the blown film technique. Thus, it has been proved possible to produce blown films only 0.5 mils thick. It was also demonstrated that the S3P process allows for the recycling of post-consumer agricultural waste films into useful uniform coloured material for closed-loop recycling. 2 refs.

USA
Accession no.859137

Item 47
Popular Plastics and Packaging
47, No.6, June 2002, p.61/6

POLYMERS IN AGRICULTURAL APPLICATIONS
Kumar V; Singh M
Sant Longowal Institute of Engineering & Technology

A general discussion is presented on the use of polymers in packaging, automotive applications, building applications, electrical applications and electronic applications followed by a detailed discussion on polymers in agricultural applications, including mulches, controlled release applications and soil conditioners. Tables are included showing the applications of polymers in the controlled release of biologically active chemicals and important applications of various polymers in the agricultural sector. 8 refs.

INDIA
Accession no.859137

Item 48
Scrap Tire News
16, No.6, June 2002, p.13

ART ‘RETREADS’ SOFTBALL FIELD WITH REBOUND
Details are given of the Baldwin Jr.-Sr. High School’s softball field remediation project. The Baldwin, Fl. School, in a cooperative project with Ford Motor Company and American Rubber Technologies, has recently installed the patented Rebound turf management
system which uses crumb rubber from recycled scrap tyres to aerate and cushion the ground and improve drainage. Rebound is a special blend of crumb rubber and organics that is rottotilled into the ground and designed for use under turf that is routinely subjected to heavy use.

AMERICAN RUBBER TECHNOLOGIES INC.; FORD MOTOR CO.
USA
Accession no.857876

Item 49
Kunststoffe Plast Europe
92, No.6, June 2002, p.19-21
TUBES FOR DRIP IRRIGATION
Kertscher E
K-Engineering

Problems, which have been encountered in the manufacture of tubing for drip irrigation, including tube systems with flat drippers and tube systems with cylindrical drippers, are discussed and solutions to these problems, which have resulted in increased production output and improved quality irrigation tubing, are described. (Kunststoffe, 92, No.6, 2002, p.74-6)
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.857170

Item 50
Polymer Testing
21, No.5, 2002, p.507-12
MEASURING STRAINS OF LDPE FILMS. THE STRAIN GAUGE PROBLEMS
Briassoulis D; Schettini E
Athens, Agricultural University

The elastic mechanical behaviour of LDPE films was investigated experimentally and numerically. Different approaches were used to measure the strain at selected points of the LDPE film under pressure and also in attempting to measure the Poisson’s ratio. Difficulties leading to failure in the measurement of strains of LDPE films are presented along with the analysis concerning the failure of commercial strain gauges for the measurement of strain of LDPE films. 6 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; GREECE; WESTERN EUROPE
Accession no.856867

Item 51
Journal of Microencapsulation
PREPARATION AND CHARACTERISATION OF MICROCAPSULES OF WATER-SOLUBLE PESTICIDE MONOCROTOPHOS USING POLYURETHANE AS CARRIER MATERIAL
Shukla P G; Kalidhass B; Shah A; Palaskar D V
India, National Chemical Laboratory; Indian Institute of Technology

Microencapsulation of the water soluble pesticide monocrotophos (MCR), using PU as the carrier polymer, is developed using two types of steric stabilisers, namely PLMA macrodiol and PLMA-g-PEO graft copolymer. The microencapsulation process is carried out in non-aqueous medium and at a moderate temperature to avoid any chemical degradation of monocrotophos during the encapsulation process. Microcapsules are characterised by optical microscopy and SEM for particle size and morphology, respectively. The effects of loading of MCR, crosslink density of PU and nature of steric stabiliser on the release of MCR from PU microcapsules are studied. 30 refs.
INDIA
Accession no.852924

Item 52
Plastics Additives and Compounding
4, No.3, March 2002, p.20-4
LIGHT MANIPULATING ADDITIVES EXTEND OPPORTUNITIES FOR AGRICULTURAL PLASTIC FILMS
Edser C

Plastic cladding is traditionally used in both agriculture and horticulture to protect plants from low temperatures and from damage by excessive UV radiation. Additives were first used in these films to improve their UV stabilisation; later, thermal stabilisers were also incorporated. Further developments have focused on improving the growing conditions provided by the films, with the introduction of anti-fogging agents and additives that modify the heating effects obtained. Now, the drive for ever-increased productivity has seen the incorporation of additives to control pests, and the development of specialised additives that manipulate the light transmitted by the films in order to enhance the actual processes of plant growth. The availability of additives that can boost plant productivity while reducing the need for growth adjusting chemicals will allow manufacturers of plastic film to offer a whole new range of functionality to the plant growers. Now a new family of additives for agricultural film is emerging capable of enhancing the productivity of the crops by manipulating the light available for photosynthesis. Details are given of Ranita Europe’s Ksanta additive, which employs a unique light-transforming mechanism to boost the available levels of red light. 6 refs.
RANITA EUROPE AG
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.850116

Item 53
European Plastics News
29, No.4, April 2002, p.20-1
GROWING OPPORTUNITIES
Achon M
Spain uses more agricultural film than any other country in Europe, and as such is a leader in “plasticulture”. Films that resist UV photodegradation using UV stabilisers will last longer. Thermic films retain the heat emitted from the earth’s surface during the night and keep it inside the greenhouse. Photoselectivity is another important property. Three layer films make it possible to combine proper basic polymer properties and additives in each layer. A typical three-layer film is LDPE/EVA/LDPE.

Spain’s province of Almeria has 54% of its total surface covered by greenhouses, which make up the largest concentration of greenhouses in the world. LDPE and EVA are the plastics most commonly used for greenhouses and tunnels. Mulching uses LLDPE for its good mechanical properties which allow low thickness film.

The reprocessing and restabilisation of post-consumer PE films from greenhouses were studied. An attempt was made to improve product performance by the addition of four different Irganox antioxidants when the recycled films underwent intensive shear processing. The process was evaluated by measuring the changes in chemical structure (carbonyl evolution) as well as the rheological and mechanical characteristics (tensile properties). The effectiveness of the various additives was estimated and the one with the best antioxidant ability was identified. The analysis of processing conditions showed that the best results were obtained by continuous addition of the stabiliser at each step of reprocessing. 10 refs.

Ciba Speciality Chemicals

Item 57

Revue Generale des Caoutchoucs et Plastiques
78, No.797, Sept.2001, p.38-43
French

RELIABILITY OF POLYMERIC MATERIALS IN PLASTICULTURE
Lemaire J
Blaise Pascal, Universite

A review is presented of topics concerned with the use of plastics films in greenhouse coverings, mulches and other agricultural and horticultural applications which were discussed at a conference held at Ecole Nationale Superieure de Chimie de Clermont-Ferrand on 22nd March 2001. Most of the papers reported studies of light ageing and light stabiliser systems, and aspects of biodegradability and resistance to agricultural chemicals were also covered.

Centre National D’Evaluation de Photoprotection; Ecole Nationale Superieure de Chimie de Clermont-
FERRAND; CIBA SPECIALTY CHEMICALS; ATOFINA; CLARIANT; CYTEC; GREAT LAKES CHEMICAL CORP.; REPSOL-YPF; CONSTAB POLYMER-CHEMIE; EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; GERMANY; SPAIN; SWITZERLAND; USA; WESTERN EUROPE

Accession no.846239

Item 58
ACS Polymeric Materials Science and Engineering Fall Meeting, Volume 85.
Chicago, IL, 26th-30th August 2001, p.375-6.012

INFLUENCE OF PLANT GROWTH HORMONE CONTAINING POLYMERS ON FOOD CROP SEED GERMINATION-KINETIN AND KINETIN CONTAINING POLYMERS
Carraher C E; Chamely D M; Carraher S M; Stewart H H; Learned W; Helmy J; Abey K
Florida, Atlantic University; Florida, Center for Environmental Studies; Texas A & M University; Flying Circle L Ranch
(ACS, Div. of Polymeric Materials Science & Engng.)

Polymers containing the hormone kinetin were prepared by polycondensation, using a chloroform or carbon tetrachloride solution of a metallocene dichloride blended with an aqueous solution containing kinetin. Treatment of seed with the hormone-containing polymer resulted in significant increases in germination. 11 refs.

USA
Accession no.840849

Item 59
Modern Plastics International
31, No.11, Nov. 2001, p.100

HORTICULTURE MARKET ALLOWS PROCESSOR TO BLOOM
Pavelka S

Landmark Plastic specialises in thermoformed and injection moulded packaging for the horticultural industry. The firm is a top player in both thermoformed and injection moulded nursery containers in the USA. It will make containers for more than 4.5 billion plants this year, for growers in 49 states and 8 countries. The privately-held firm doesn’t reveal revenues, but sales have been growing at 5 to 7% for the last four years. A key reason for Landmark’s success is said to be that the company is focused on leading-edge technology. For instance, when customers alerted Landmark of the need for a better container for retail perennials and ornamental plants than the ubiquitous black PE pot, it produced a sturdy PP container with a smooth, glossy finish, a bottom that ensures movement-free stacking, and a rim slot for holding picture tags. The container is supplied in numerous colours including custom ones, and can be direct-printed. Details are given.

LANDMARK PLASTIC CORP.
USA
Accession no.840727

Item 60
Advances in Polymer Technology
20, No.4, Winter 2001, p.305-11

CONTROLLED RELEASE OF MIGRATION OF MOLLUSCICIDAL SAPONIN FROM DIFFERENT TYPES OF POLYMERS CONTAINING CALENDULA OFFICINALIS
Helaly F M; Soliman H S M; Soheir A D; Ahmed A A
Egypt, National Research Centre; Helwan, University; Cairo, University

Triterpene saponins of marigolds were hydrolysed and examined for their molluscicidal activity. NR, SBR, and starch were used as binding matrices for the bioactive products for releasing saponin in minute amounts over long periods of time. The effect of filler on physico-mechanical properties of SBR formulations was examined. 23 refs.

EGYPT
Accession no.839536

Item 61
Revista de Plásticos Modernos
81, No.537, March 2001, p.353-5
Spanish

USE OF NATURAL POLYMERS AS NEW PHYSICAL SUPPORTS FOR SUSTAINED ACTION FERTILISERS
Piloto C; Quiroga M; Sabatier J; Sosa M; Rodriguez E; Guerra M

Cuban Institute of Sugar Cane Derivatives; Biomat

Formaldehyde crosslinked dextran hydrogels were prepared and used to coat pills of urea physically supported on a lignocellulose pith. Swelling tests were carried out on the hydrogels in deionised water, and studies were made of the release kinetics of urea fertiliser over a period of up to 75 days. 13 refs.

CUBA
Accession no.839086

Item 62
Reuse/Recycle
31, No.3, March 2001, p.23

AGRICULTURAL FILM RECYCLING INITIATIVE

In Canada, the Environment & Plastics Industry Council, the Ontario Ministry of Agriculture, and the Ontario Soil & Crop Improvement Association have launched a partnership to investigate opportunities to efficiently and effectively recycle agricultural plastics in the province. This short article briefly outlines the objectives of their programme.

CANADA, ENVIRONMENT & PLASTICS INDUSTRY COUNCIL; ONTARIO, MIN. OF AGRICULTURE; ONTARIO, SOIL & CROP IMPROVEMENT ASSN.

CANADA
Accession no.838604
Item 63
International Polymer Science and Technology
28, No.11, 2001, p.T/57-9

ABSORPTION OF UV RADIATION BY POLYETHYLENE FILMS WITH ADDITION OF LUMINOPHORES BASED ON EUROPIUM COMPOUNDS
Raida V S; Koval E O; Minich A S; Akimov A V; Tolstikov G A
Russian Academy of Sciences

Tests carried out in Russia and abroad on polymer films with additions of luminophores based on complex europium compounds have demonstrated their value under greenhouse conditions in shortening the maturation time, accelerating growth and increasing the yield of agricultural crops to 100% by comparison with films without modifying additives. This property of the given films is referred to as the ‘polylight’ effect. However, despite the high effectiveness of using such films, their photophysical properties have hardly been investigated to date. An attempt is reported to study the values of transmission and absorption of UV radiation by LDPE films with additions of complex europium compounds. 8 refs. (Article translated from Plasticheskie Massy, No.3, 2001, pp.31).

RUSSIA
Accession no.838065

Item 64
Scrap Tire News
15, No.11, Nov. 2001, p.18

WINTER WATERING OPTION
Scrap mining tyres are being used as a watering station for livestock. The watering station is made by OTR Recycling and is heated with geo-heat.

OTR RECYCLING
USA
Accession no.835988

Item 65
Plastics Additives and Compounding
3, No.11, Nov. 2001, p.18-21

ANTI-FOG ADDITIVES GIVE CLEAR ADVANTAGE
Wagner P
Uniqema Polymer Additives

Some of the problems caused by fogging in applications of plastics films in the food packaging and agricultural sectors are identified and the use of anti-fogging agents in agricultural applications is discussed. Critical issues involved in the design and formulation of anti-fogging agents are considered and examples of their use in three-layer films for agricultural applications are presented.

SWITZERLAND; WESTERN EUROPE
Accession no.834945

Item 66
Revista de Plasticos Modernos
81, No.535, Jan.2001, p.120-5
Spanish

PLASTICS FOR THE MODERNISATION OF IRRIGATION SYSTEMS
Llanos M
Regaber SA

The use of plastics in irrigation pipes is discussed, and some other applications of plastics in agriculture and horticulture are briefly reviewed. Turnover and employment figures and other company details are presented for Regaber of Spain, a specialist in products for water management and control.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE
Accession no.831310

Item 67
Polymer International
50, No.8, Aug.2001, p.946-51

SYNTHESIS OF NOVEL SUPERABSORBING COPOLYMERS FOR AGRICULTURAL AND HORTICULTURAL APPLICATIONS
Raju K M; Raju M P
Sri Krishnadevaraya University

A series of superabsorbent copolymers(SAPs) based on acrylamide, calcium acrylate and sodium acrylate was prepared using ammonium persulphate as initiator and N,N-methylene bisacrylamide(MBA) as crosslinking agent, the concentrations of monomer, MBA and initiator being varied. The experimental results showed that the SAPs had good absorbency in both water and sodium chloride solutions. The copolymers were characterised by IR spectroscopy. Water retention in soil was enhanced by use of these superabsorbsents. The effect of SAPs on the growth of bean plants was examined. SAPs were shown to be of potential use as water management materials for agricultural and horticultural purposes in desert and drought-prone areas. 22 refs.

INDIA
Accession no.827500

Item 68
Applied Spectroscopy
55, No.7, July 2001, p.858-63

OPTICAL CHARACTERIZATION OF POLYMERIC FILMS BY A NEW METHODOLOGICAL APPROACH
Mormile P; Petti L; Immirzi B; Malinconico M; De Luca V; Manera C
CNR; Potenza,Basilicata Universita

A method of evaluating polymeric films in agricultural applications is proposed. The method consists of optical characterisation and numerical elaboration of the data on the basis of a theoretical model. Results for new
biodegradable materials for mulching and soil solarisation are presented and compared with traditional materials. Data are presented for agarose film, PVAL, polycaprolactone and polyesteramide. 15 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE
Accession no.826995

Item 69
Plasticulture
2, No.120, 2001, p.154-5
FIVE LAYERED GREENHOUSE COVERS
Ginegar Plastic Products
Several products, including Sun Selector from Ginegar Plastic Products, available for agricultural applications are highlighted along with companies making greenhouse covers.
EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; ISRAEL; SPAIN; WESTERN EUROPE
Accession no.826477

Item 70
Plasticulture
2, No.120, 2001, p.108-26
English; Spanish; French
PLASTICS IN THE WORLD
Jouet J-P
Comite des Plastiques en Agriculture
Economic information on the worldwide use of plastics in agriculture is provided. The different types of plastics used in agriculture are indicated and statistics are included on estimated world consumption of plastics in agriculture, area of land covered by plastics in the form of tunnels, mulches and the like and the world market for stretch wrapping, hydroponic systems irrigation systems and PP twine.
EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE
Accession no.826472

Item 71
Plasticulture
2, No.120, 2001, p.88-105
English; Spanish; French
PLASTICULTURE IN CUCUMBER CULTIVATION IN NEPAL
Singh R M
Nepal,Royal Academy of Science & Technology
The cultivation, harvesting, transportation, marketing and economies of production of cucumbers in Nepal are described and discussed. Cucumbers are generally grown in PE tunnels, which enable the production of cucumbers out of season. 10 refs.
NEPAL
Accession no.826471

Item 72
Plasticulture
2, No.120, 2001, p.10-30
English; Spanish; French
DESIGN AND CONSTRUCTION OF PLASTIC FILM GREENHOUSES
von Zabeltitz C
Hannover,Universitat
Various aspects relating to the design and construction of greenhouses in accordance with European Standard EN 13031-1:2000 are discussed. These include climate conditions and climate control, general greenhouse design requirements, advantages and disadvantages of different greenhouse designs, the requirements of connections/clamps, greenhouse foundations and cladding materials, fastening and stretching of plastics films and ventilation.
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.826470

Item 73
Plastics Additives and Compounding
3, No.7/8, July/Aug. 2001, p.10
ATMER 400 DEMONSTRATES LONG LASTING ANTI-FOGGING PERFORMANCE
Uniqema is reported to have developed a new anti-fogging product for use in three-layer greenhouse and other agricultural films. Atmer 400 is claimed to have shown good anti-fogging properties in long-term laboratory evaluations, and is currently being trialled with a number of customers. The optimum film formulation has been developed in combination with Ciba Specialty Chemical’s new UV stabiliser Tinuvin NOR 371. Brief details are given of the laboratory trials.
UNIQUEMA; CIBA SPECIALITY CHEMICALS
Accession no.825848

Item 74
Polymer Plastics Technology and Engineering
40, No.4, 2001, p.437-50
POLYMERS FOR AGRICULTURAL APPLICATIONS: CONTROLLED-RELEASE POLYMERIC FORMULATIONS WITH PENDANT 2,6-DICHLOROBENZALDEHYDE
Kenawy E R
Tanta,University
Two polymeric formulations of dichlorobenzaldehyde (DCBA) were prepared by modification of both linear and crosslinked polyglycidyl methacrylate. The modifications were carried out by first hydrolysing the epoxide functionalities of linear and crosslinked polymers to diol groups in the presence of an acid catalyst. The diol polymers were then acetalised by reacting it with DCBA. The swelling behaviour of the crosslinked polymers in different solvents was investigated. The release characteristics of the formulation were studied in
neutral, alkaline and acidic media. The effect of the temp. and crosslinking on the release of the bioactive agent (DCBA) was also investigated. 21 refs.

EGYPT
Accession no. 824996

Item 75
Paper Film and Foil Converter
75, No.7, July 2001, p.16
AGRICULTURAL PLASTIC FILM RECOVERY PROJECT ENTERS SECOND PHASE

The first phase of an investigation into the recovery of agricultural plastic film used on farms is reported to have been completed, according to Canada’s Environmental & Plastics Industry Council. The goal of the next phase is to pilot different methods of collection and assembly of plastics films.

CANADA, ENVIRONMENT & PLASTICS INDUSTRY COUNCIL
Accession no. 823130

Item 76
ENHANCING POLYMERS USING ADDITIVES AND MODIFIERS II. Proceedings of a conference held Shawbury, UK, 14th November 1996.
Shawbury, 1996, paper 4, p.1-6. 012
IMPROVED LIGHT STABILISERS FOR POLYETHYLENE FILM
Straughan R; O’Driscoll A J; Gugumus F; Henninger F
Ciba Additives; Ciba-Geigy Ltd.
(Rapra Technology Ltd.)

The fundamentals of photooxidation in general and in particular in relation to agricultural greenhouse films are discussed and various strategies available for limiting the damage caused by photooxidation, including competitive UV absorption, excited state quenching and free radical scavenging, are discussed. Finally, the development of two pesticide-resistant hindered amine light stabilisers, Tinuvin 492 and Tinuvin 494, which have been developed for the stabilisation of LDPE greenhouse films, using such strategies, is reported. 10 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE
Accession no. 818769

Item 77
Journal of Industrial Textiles
30, No.4, April 2001, p.311-9
INNOVATIVE APPROACH TO SPUNBOND AGRICULTURAL CROP COVER
Avril D
Don & Low Group

A report is presented on the innovations and changes which Don & Low has introduced to improve the laboratory and field performance of its range of non-woven spunbond agricultural crop cover fabrics. The use of crop cover is described and the physical properties which are important when spunbond is used as a crop cover are considered. A new PP polymer is evaluated to improve these fabric properties. Agricultural field investigations conducted to quantify fabric improvements are detailed, physical properties of a fabric measured in the laboratory are directly related to its actual performance in the field, and other improvements made to the performance of the crop cover fleece are mentioned.

EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no. 820410

Item 78
POLYMERIC THERMAL FILMS FOR USE IN AGRICULTURE
Espi Guzman E; Salmeron Cano A
Repsol Quimica SA

These films contain at least 85 wt.% of a polyolefin, such as LDPE, LLDPE, EVA or ethylene-butyl acrylate copolymer. Addition of between 1 and 15% of the mixture of, at least, a borate stable in the processing conditions and at least one compound, such as silica, silicate, carbonate or sulphate, imparts to these compositions a high opacity in the infrared region of the spectrum, without substantially interfering with the visible light necessary for photosynthesis.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE; WESTERN EUROPE-GENERAL
Accession no. 818769

Item 79
Patent Number: EP 1095963 A1 20010502
TRANSPARENT SYNTHETIC FILM SUITABLE TO BE USED AS A COVER IN AGRICULTURE, PARTICULARLY IN GREENHOUSE CULTIVATION, AND RELATIVE PRODUCTION METHOD
Zanon M
Pati SpA

The film comprises a base layer consisting of at least two heterogeneous polymers having different molecular structures, which cannot be combined from a molecular point of view, but which can be amalgamated due to their rheological characteristics. The method involves feeding the heterogeneous polymers towards the extrusion head of an extrusion device by feed means provided with heating means for heating the polymers to a particular temperature near the melting temperature of the polymer, which has the lower melting point.

EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE; WESTERN EUROPE-GENERAL
Accession no. 818768
Item 80

Revista de Plásticos Modernos
80, No.531, Sept.2000, p.305-16
Spanish
THERMIC FILMS: CONCEPTS, COMPOUNDS AND HARVESTS
Espí E; Salmerón A; Catalina F
Repsol-YPF; Instituto de Ciencia y Tecnología de Polímeros

The use of thermic films (i.e. films opaque to long wavelength IR radiation) as greenhouse coverings is discussed. Their mode of operation is examined with reference to the laws governing heat transmission by radiation and the characteristics of radiation exchanges between the soil and the atmosphere. Types of mineral fillers used in LDPE and EVA films to increase their IR opacity are reviewed, and results are presented of trials carried out in Spain in the cultivation of cucumbers and beans in heated greenhouses covered with LDPE thermic films. The optical and mechanical properties of films evaluated in this study are compared with those of conventional LDPE films. 25 refs.

Accession no.818394

Item 83

Revista de Plásticos Modernos
80, No.531, Sept.2000, p.252/6
Spanish
STANDARDISATION OF PLASTICS IN AGRICULTURE
Ruiz J M, ANAIP

Standardisation in Spain and the European Union relating to plastics and rubber products for use in agriculture and horticulture is examined. Spanish standards covering pipes, geomembranes and greenhouse covering films are reviewed.

Accession no.818390

Item 84

Tire Business
18, No.22, 12th Feb.2001, p.10

TRACKS GAINING GROUND
Fedchenko V

We are told that according to current trends, rubber tracks, as oppose to tyres, will in future be the choice fitment for agricultural tractors with high-horsepowered engines, meaning that tyre dealers will need to sell tracks, and know how to service them. This article discusses this prediction and looks at the advantages and disadvantages of tracks on tractors.

Accession no.818279

Item 85

Plastics and Rubber Weekly
4th May 2001, p.1

'MOO-TAG' COULD HELP FIGHT FOOT-AND-MOUTH

DuPont's ‘moo-tag’, which is fed to cows and sits in their stomachs for the rest of their lives as a means of permanent electronic identification, is briefly described. The tag consists of a passive radio frequency transponder, with an outer shell moulded from Dupont's Hytrel polyester TPE. The application was developed with AVID Animal Identification Systems.

Accession no.817565
**Scrap Tire News**

15, No.5, May 2001, p.9

**NC COMPANY MAKES INROADS IN RUBBER MULCH MARKET**

Rubber Mulch, Etc. collects tyre buffings derived from the retreading of large equipment tyres, and processes them into mulch form for use by landscapers and home-owners. The mulch can be coloured using a proprietary process. Benefits of rubber mulch over traditional wood-based mulches are discussed. The North Carolina Department of Transportation is considering using the mulch statewide at rest areas, and trials have also led to its use in school playground surfacing.

RUBBER MULCH, ETC.

USA

Accession no.817067

**Patent Number: US 6168840 B1 2000102**

**STRETCHED PLASTIC FILM FOR AGRICULTURAL USE**

Johnstone P

First Green Park Pty Ltd.

There is disclosed the provision of a plastic film for covering soil for use in cropping or covering a frame for greenhouse effect. At least part of the plastic film has been stretched beyond its yield point prior to application. In alternative forms, the film undergoes a secondary stretch to form a predetermined pattern of weakness in certain localised areas of the film. The film may be photodegradable and biologically degradable to accelerate decomposition of the film when exposed to the elements.

AUSTRALIA; USA

Accession no.815091

**Modern Plastics International**

31, No.4, April 2001, p.54-5

**PLASTICULTURE PROMISES TO RAISE CROP YIELDS, TEMPER NATURE**

Leaversuch R

There is a growing use of plasticulture, or the practice of using PE films to meet an expanding spectrum of agricultural needs. Today’s agricultural films are used to increase crop yields, extend the climatic range under which crops can grow, conserve water and energy, reduce pest infestation and store animal silage. Films are being tailored for given geographic regions and specific goals. Several leading film extruders in Europe and Canada have commercialised films that draw on metallocene PE to offer high toughness via downgauging of mulch and silage films and better opticals for improved light transmission greenhouse films. Fluorescent films utilise colourants able to absorb wavelengths that do little to stimulate plant growth, while emitting others that stimulate it.

WORLD

Accession no.814468

**Tyres and Accessories**

No.1, 2001, p.25/9

**EUROPEAN MARKET FOR AGRICULTURAL TYRES**

The current European agricultural tyre market is discussed in detail in this article. Following an introduction, section headings include: fewer tractor producers, fewer agricultural tyre producers, fewer agricultural tyre dealers, more types of agricultural tyres, and the replacement market.

AGCO GROUP; CASE; SAME TRATTORI; FIAT; CONTINENTAL; GOODYEAR; FIRESTONE; TAURUS; STOMIL; PIRELLI; TITAN; VREDESTEIN; MICHELIN; KLEBER; NOKIAN; GALAXY TIRE; TOFAN GROUP; FULDA

EUROPEAN UNION; EASTERN EUROPE-GENERAL; EASTERN EUROPE; EUROPE-GENERAL; EUROPEAN UNION; EUROPEAN COMMUNITY; FINLAND; HUNGARY; ITALY; NETHERLANDS; NORTH AMERICA; POLAND; RUMANIA; SCANDINAVIA; WESTERN EUROPE; WESTERN EUROPE-GENERAL; WORLD

Accession no.813140

**Patent Number: EP 1080878 A2 20010307**

**IMPROVED FILMS**

Wheldon A E; Davis F J; Gilbert A; van Haeringen C J; Pearson S; Hadley P; West J S; Henbest R G C

British Polythene Ltd.

A film for use in cultivation of plants comprises a number of layers, at least one of which imparts light transmission modifying properties to the film and is selected from a condensation polymer which is compatible with polyolefins under film-forming conditions. The layers also incorporate at least one phthalocyanine compound having a specific light absorption peak between 720 and 780 nm and a maximum absorption coefficient in the range of at least twice that of any other absorption peak in the 400 to 700 nm band. At least one other of the layers is a durable weather resistant polyolefin or copolymer, which exhibits substantially no adverse interference with the light transmission modifying properties of the, or each, light transmission modifying layer.

EUROPEAN UNION; EUROPEAN COMMUNITY; UK; WESTERN EUROPE; WESTERN EUROPE-GENERAL

Accession no.809845

**Patent Number: US 6153665 A1 20001128**

**DOPED POLYMER SHEETING FOR COVERING HOTBEDS AND GREENHOUSES AND METHOD OF FABRICATION OF SUCH**

Goldburt E T; Bolchouchine V A; Levonovitch B N; Sochtine N P

Ram Phosphorix LLC

A mechanically strong doped polymer sheeting - high-density polyethylene film, which exhibits excellent
durability, high maintenance and light transmission for covering hotbeds and greenhouses comprises a light-transforming additive based on yttrium-europium oxysulphide, a light stabiliser based on polyaminosuccinate and a polymer used to form the high-density polyethylene 6-mil film. A preferred composition comprises yttrium-europium oxysulphide in an amount of 0.05 to 0.5% by weight, polyaminosuccinate in an amount of 0.1 to 1% by weight, the ratio of yttrium-europium oxysulphide to polyaminosuccinate ranging from 0.5:1 to 1:2, and HDPE in an amount of over 98.5% by weight. The film enables the transformation of UV light into a wavelength, which promotes photosynthesis in crops, enhances crop growth and increases greenhouse internal ambient temperature leading to an extended growing season, higher crop quality and yield and frost protection. The properties and the sheeting last for two or more years.

USA
Accession no.808878

Item 92

British Plastics and Rubber
Jan.2001, p.27

“SMART” FILM CONTROLS PLANT GROWTH

It is briefly reported that a horticultural film from BPI Agri contains filters to modify the ratio of red to far red light that it transmits to prevent runaway growth forming “leggy” plants. Use of this “smart” film, called Visqueen Solatrol, reduces or eliminates the need for chemical growth regulators.

BPI AGRI
EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.807062

Item 93

Asian Plastics News
March 2001, p.13-4

IRRIGATING INDIA’S CROPS

Rambhia A

Jain Irrigation Systems have developed various irrigation systems that can minimise water use, maximise yields and improve the quality of produce. The company manufactures PE hoses and tubes, fittings, drippers, emitters, sprinklers, plastics control and safety valves, pressure pipes and fittings, and other accessories. Each micro-irrigation system is tailored and installed on a turnkey basis. Jain is the only manufacturer in India for in-line dripper systems which are used to compensate pressure for uniform distribution of water during irrigation. The company exports nearly 20 million pieces of drippers per year and has a 65% share of the Indian market. The manufacturing facility at Jalgaon is a complex with several plants. One houses 20 extrusion lines for PVC pipes and another has 55 injection moulding machines.

JAIN IRRIGATION SYSTEMS LTD.
INDIA
Accession no.807000

Item 94

Patent Number: US 6120634 A1 20000919

METHOD AND APPARATUS FOR FORMING AGRICULTURAL DRIP TAPE

Harrold C R; Bren T J
Micro Irrigation Technologies Inc.

A process for forming irrigation drip tape includes, broadly, the steps of a) supplying a longitudinally continuous strip of flexible plastic material in a first direction; b) heating a narrow band of the strip along a longitudinal axis thereof; c) depositing a continuous bead of material on an upper surface of the strip, along the narrow band, while the strip moves in the one direction; d) cooling the strip and the bead; e) folding the strip longitudinally so that the longitudinal edges overlap; and f) sealing said longitudinal edges overlap; and a second station including a trimming roll and a pair of associated knife blades arranged to trim opposite longitudinal edges of the material to form a strip of predetermined width; a third station including a slitter wheel arranged to cut axially spaced longitudinal slits in the strip; a fourth station for applying a preformed bead of material onto a surface of the strip, the bead having one or more secondary flow paths formed therein; and a fifth station including a plurality of rollers arranged to wrap the strip about a mandrel into tubular form; a nozzle arranged to apply an adhesive bead along one of the longitudinal edges of the strip; and at least one pressure roller for applying pressure along the longitudinal edge to form a bonded seam between the longitudinal edges of the strip.

USA
Accession no.804223

Item 95

Houston, Tx., 27th Feb.-1st March 2000, p.687-98

EFFECT OF PESTICIDES ON UV STABILISATION

Glans J; Vulic I; Wagner A H
Cytec Industries Inc.
(SPE,South Texas Section; SPE,Thermoplastic Materials & Foams Div.; SPE,Polymer Modifiers & Additives Div.)

To be successful a UV stabilisation package for polyolefins must remain active in the film during its lifetime, i.e. have high permanence. The UV stabiliser needs to have high inherent light stability, low volatility and should not interact with other ingredients in the additive package. The lifetime of a stabilisation package can be shortened if the additives are too volatile, are insoluble or exhibit excessive migration in the polyolefin matrix. A successful UV stabilisation package in
agricultural films must also be resistant to attack by pesticides. When the UV stabilisation package contains a UV absorber, the effects of the absorber on plant growth, fruit and flower quality, moulds and viruses, and pollination must also be considered. The best stabilisation performance would occur if the UV absorber blocked 100% of the incident radiation between 280 and 400 nm. However, UV light must penetrate the greenhouse for satisfactory plant growth. The light from 320 to 400 nm has a formative effect on the plant while light from 280 to 320 is detrimental to most plants. Fungus growth and rose petal darkening will also occur at 280 to 320 nm. To further complicate things, bees need light less than 360 nm to see for pollination. The effect of pesticides and simulated pesticides on the performance of a wide range of UV stabilisers is explored. 15 refs.

Item 96
Modern Plastics International
30, No.12, Dec.2000, p.40/2
MULTILAYER STRUCTURES HELP PROTECT CROPS, OZONE LAYER
Colvin R
To help farmers meet strict regulations on use of toxic methyl-bromide gas as a pesticide, three- and five-layer blown barrier tarps are offering a niche opportunity for blown film processors. By using a special coextruded multilayer gas barrier film, the farmer can reduce emission levels to 34%, compared with 68% with a monolayer film. Luigi Bandera has sold six film lines for the production of such agricultural barrier films in Israel and Italy. Polymer producer Repsol-YPF is considering a different method to control pests with blown film for greenhouses. The company recently introduced a PE compound based on a combination of organic UV absorbers for monolayer photosensitive films. These UV-blocking webs are designed to prevent development of plant diseases caused by fungi and viruses.
BANDERA L.,SPA; REPSOL-YPF
EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; SPAIN; WESTERN EUROPE
Accession no.800525

Item 97
Polymer Bulletin
RELATIONSHIP BETWEEN THE SWELLING PROCESS AND THE RELEASES OF WATER SOLUBLE AGROCHEMICALS FROM RADIATION CROSSLINKED ACRYLAMIDE/ITACONIC ACID COPOLYMERS
Saraydin D; Karadag E; Guven O
Cumhuriyet,University; Adnan Menderes University; Hacettepe,University
An attempt was made to relate the releases of water-soluble herbicide (sodium 2,2-dichloropropionate (Dowpon)) and model fertilisers (ammonium nitrate, potassium nitrate and ammonium sulphate) from the cylindrical devices of radiation-crosslinked poly(acrylamide/itaconic acid) copolymers to the swelling that could affect the release behaviour. The copolymers containing agrochemicals were prepared by two different compositions of itaconic acid and two different gamma-ray doses. The agrochemicals were trapped in the gels by including them in the feed mixture of radiation polymerisation. The equilibrium swelling, diffusional exponent and diffusion and intrinsic diffusion coefficients of the process were obtained. The agrochemical dissolution was determined by conductimetry. The maximum concentrations of releasing agrochemicals and initial releasing rates were calculated by using the second-order kinetics equation. The agrochemical releases appeared to be controlled by swelling. As a result, if the copolymer hydrogels containing agrochemicals were swelled in water, release of agrochemicals was decreased with increasing gamma-ray doses and itaconic acid quantities in the hydrogel. 21 refs.
TURKEY
Accession no.800126

Item 98
Patent Number: US 5945132 A 19990831
APPARATUS FOR MAKING COMPRESSED AGRICULTURAL FIBER STRUCTURAL BOARD
Sullivan B J; Du Mouchel I. J
Agriboard Industries
A mill is described for compacting agricultural fibrous matter, such as straw or other agricultural waste, into a structural board. The board is useful as a dominant part of a load bearing and insulating panel replacing many of the load bearing and insulating structures typically used to make small buildings, such as houses. The mill includes many features not found in previous mills of this type, including not only a packer to place material in front of an oscillating ram head as is known, but a precompactor arrangement to regulate the volume of material fed to the packer. Another feature incorporated into the mill to aid in achieving a consistent density is a pressure offset mechanism which adjusts the rate of core formation. The mill has a modular design to facilitate replacement of those components subjected to significant wear.
USA
Accession no.800126

Item 99
Modern Plastics International
30, No.11, Nov.2000, p.20
PLASTIC MATS ARE A BOON ON THE FARM, SAYS STUDY
The Dutch state agriculture institute H.A.S. has revealed after a two-year study that cows that have floors lined
with plastics mats give 1L more milk per day than cows in more traditional spartan stalls. The study tested cows which slept on the Pillow Mattress produced by Schmitz Kunststoff Recycling, it is briefly reported. The 50mm thick polyolefin foam mats are made of thermally bonded post-production waste in a watertight cover.

SCHMITZ KUNSTSTOF RECYCLING
EUROPEAN COMMUNITY; EUROPEAN UNION; NETHERLANDS; WESTERN EUROPE
Accession no.795182

Item 100
Plastics Newsletter
No.8, 2000, p.6-10
Chinese
APPLICATIONS OF MICROENCAPSULATION TECHNOLOGIES IN PESTICIDE FORMULATIONS
Delin G A O
Nantong Pesticide Formulation Development Centre

This article outlines the advantages and function of pesticide microcapsules which represent an important development trend in pesticide formulations for the future. Emphasis is placed on fundamental processes of interfacial polycondensation and in-situ interfacial polycondensation. The controlled-release mechanism and commercial microencapsulated pesticides are also described. 10 refs.
CHINA
Accession no.792657

Item 101
New Scientist
JUICY FRUIT
Graham-Rowe D

A new polymer film which blocks infrared light has been developed by 3M for use on greenhouse glass, to prevent hothouses from becoming too hot, thus negating the need for horticulturalists to open windows and lose the high concentrations of carbon dioxide and moisture which help plants to grow well.
3M; OPTICAL COATING LABORATORIES
USA
Accession no.792057

Item 102
Plast’21
Nos.93/4, June/July 2000, p.20-2
Spanish
ANALYSIS OF FILMS USED IN AGRICULTURE
Leonidopoulos G

The mechanical and optical properties required of plastics greenhouse covering films are examined, and data are presented for the IR transmission and light diffusion of LDPE, EVA and PVC films based on compounds produced by Repsol YPF. Developments in non-drip and photoselective films are reviewed.
EU; EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE; WESTERN EUROPE-GENERAL
Accession no.790856

Item 103
Plast’21
Nos.93/4, June/July 2000, p.20-2
Spanish
NEW DEVELOPMENTS IN GREENHOUSE COVERINGS: A PRODUCT FOR EVERY NEED
Diaz T
Repsol YPF

The mechanical and optical properties required of plastics greenhouse covering films are examined, and data are presented for the IR transmission and light diffusion of LDPE, EVA and PVC films based on compounds produced by Repsol YPF. Developments in non-drip and photoselective films are reviewed.
EU; EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE; WESTERN EUROPE-GENERAL
Accession no.790857

Item 104
Polymer Testing
19, No.7, Oct.2000, p.813-20
GREEHOUSE DAILY SUN-RADIATION INTENSITY VARIATION, DAILY TEMPERATURE VARIATION AND HEAT PROFITS THROUGH THE POLYMERIC COVER
Leonidopoulos G

Experimental studies were carried out in order to measure the daily variation of greenhouse interior and exterior sun-radiation intensity and temperature. The behaviour of PE greenhouse covers were examined. 2 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; GREECE; WESTERN EUROPE
Accession no.786637

Item 105
Polymer Testing
19, No.7, Oct.2000, p.801-12
GREEHOUSE DIMENSIONS ESTIMATION AND SHORT TIME FORECAST OF GREENHOUSE TEMPERATURE BASED ON NET HEAT LOSSES THROUGH THE POLYMERIC COVER
Leonidopoulos G

The heat losses of greenhouses were mathematically developed and calculated. The time for the greenhouse to achieve thermal equilibrium was estimated. A method that estimates the greenhouse dimensions when one or more constraints are set regarding the heat losses through the PE cover is presented. 2 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; GREECE; WESTERN EUROPE
Accession no.786636
Field Exposure Study of Polylactic Acid (PLA) Plastic Films in the Banana Fields of Costa Rica

Ho K-L G; Pometto A L; Hinz P N; Gadea-Rivas A; Briceno J A; Rojas A
Iowa State University; Costa Rica, Universidad Cargill EcoPla Generation II and Cargill EcoPla monolayer polylactic acid films were exposed to the environment in a banana field at La Rebusca Farm and at an experimental weathering station of the University of Costa Rica and their rate of biodegradation investigated. The mechanical properties (tensile strength, percent elongation and strain energy) of the films at both sites were compared. The films at the farm site were found to degrade at a faster rate than at the weathering station due to differences in climate and the monolayer film was considered suitable for further study as ropes and shrouds for bananas because it satisfied a 14-week operational time frame. 10 refs.

Photo-Stabilisation Mechanism Under Natural Weathering and Accelerated Photo-Oxidative Conditions of LDPE Films for Agricultural Applications

Scoponi M; Cimmino S; Kaci M
CNR; Bejaia, University
Spectroscopic methods, UV and Fourier transform infrared (FTIR) are used to determine the concentrations of the two components of hindered amine light stabilisers (HALS) in LDPE films exposed to natural weathering up to 650 days. The HALS used is a Ciba-Geigy commercial mixture of Chimassorb 944 and Tinuvin 622 with same percentage in weight (50/50% (wt/wt)). Spectroscopic measurements are carried out on the LDPE films having some different HALS contents of 0.1, 0.2, 0.4 and 0.6% (wt/wt). The Chimassorb 944 concentration is determined by means of the absorption band area centred at 225 nm in UV spectra for the absorption of 1,3,5-triazine group, while Tinuvin 622 concentration is measured by the absorption band area at 1734 cm⁻¹ in FTIR spectra corresponding to the ester group absorption. The plots describing the loss of the concentration of each component versus time exhibit similar profiles. The results suggest that the two HALS components are involved at the same time in the polymer stabilisation processes. The effect of the HALS concentration on LDPE stabilisation is interpreted applying the well-known operative mechanisms involving piperidinoxyl radicals for natural and accelerated photo-oxidative conditions. Finally electron spin resonance spectroscopy performed on 0.6 and 0.2% under natural exposure formulations are in good agreement with the spectroscopic determination of the HALS contents in the different formulations. 26 refs.

Support for Cultivating Plant

Obonai Y; Mukoyama T
Mukoyama Orchids Ltd.
A vessel for growing a plant, comprising: a base material 11 in the form of a vessel which is capable of accommodating therein at least a part of a plant; and a hydrogel-forming polymer 12 having a crosslinked structure disposed inside of the vessel-form base material 11 is disclosed. When such a vessel is used, a transfer operation for the plant can be automated, and any damage caused by transferring the plant can be reduced.

Natural Weather has been used to study the effects of hindered amine light stabiliser incorporation into agricultural low density polyethylene films. The film structure was monitored and the effectiveness of the amine stabiliser determined. 44 refs.
demand, a greater amount of agricultural land open to irrigation, climatic changes caused by deforestation, and/or global warming. The use of PVC sheeting for agricultural reservoirs is described.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE
Accession no.778111

Item 111
Plasticulture
1, No.119, 2000, p.124-42
English; Spanish; French
USE OF PLASTIC MATERIALS FOR THE MANAGEMENT OF IRRIGATION WATER
Losada A
Madrid, Universidad Politecnica

The water cycle shows that this natural resource is renewable, but its availability is limited. Social and economic growth generates a higher water demand. Alternative uses for these resources keep us constantly under pressure. Irrigation water is particularly scarce because of the great amount of water that an irrigated crop demands, sometimes as much as 15,000 cub.m/ha/year. Rational management of irrigation water, therefore, has a great importance and the control and reduction of water use deserves special attention. The use of plastic materials has contributed to a real technological revolution in irrigation and it has sometimes helped scientific advances that have an enormous potential to improve the use of water. On the one hand, irrigation networks have been improved by plastic irrigation equipment; on the other, water has been brought under control by mulching techniques and plastic greenhouses. Plastics also play an important role in the manufacture of ancillary equipment, accessories and communication systems, which are essential elements to regulate and automate crop tasks and, particularly, irrigation. The development experienced by water management techniques in irrigation networks is described. It is suggested what current irrigation technology would be like without the support of plastic materials for the last fifty years. The importance of plastics for a better use of water in crops is underlined.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE
Accession no.778109

Item 113
Plasticulture
1, No.119, 2000, p.30-43
English; Spanish; French
PLASTICULTURE MAGAZINE: A MILESTONE FOR A HISTORY OF PROGRESS IN PLASTICULTURE
Garnaud J C

A history of the use of plastics in horticultural/agricultural applications is presented.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE
Accession no.778107

Item 114
Plasticulture
1, No.119, 2000, p.15-25
English; Spanish; French
PLASTICS AS COVER FOR GREENHOUSES AND SMALL TUNNELS
Arboli I M
Repsol Quimica SA

Greenhouses are mainly concentrated in two geographical areas: the Far East (especially China, Japan and Korea) with almost 60%, and the Mediterranean basin with scarcely over 30% of the World’s greenhouse covered area. In terms of the continents, Asia stands out with 63% of the world surface and Europe with 27%. The area covered by greenhouses in the World has been increasing millions metric tons. Between 1989 and 1996 world consumption of plastics increased at a rate of approximately 5.3%/year. Through the use of oil as primary commodity - against popular belief, a surprisingly low percentage of the total world production of crude, no more than 6 or 7% is destined to plastic fabrication - first monomers are produced and then polymers. Resins constitute the basis of thousands of different compounds which are applied today in all branches of human activity and which are known under the generic name of ‘plastics’. Agriculture has not been spared this penetration of plastic materials, of course. Especially well known is the use of plastics in protected horticulture and in many other plant production activities, like irrigation, drainage, mulching-films, etc. Due to its great resistance and duration, the use of PVC in different structures is especially extended. Plastics are also used extensively in animal production, but they have not such an obvious profile as in horticulture. The scarcity of available information on the use of plastics by this sub-sector is rather surprising, in spite of the fact that the multiple applications of these materials in cattle ranches, poultry and pig farms, etc. are very obvious. A general review is presented.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE
Accession no.778110
steadily in the past 20 years. It is estimated that in 1980 there were about 100,000 ha of greenhouses in the World and now there exists more than 485,000 ha. These figures reflect an average yearly increase of almost 20% since 1980. Current trends in the use of plastics films for greenhouse use are discussed.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE
Accession no.778106

Item 115
Revista de Plasticos Modernos
78, No.521, Nov.1999, p.504-5
Spanish
HIGH TECHNOLOGY FOR DURABLE AGRICULTURE
Developments by French companies Filclair and Irrifrance in agricultural and horticultural applications of plastics are described. These include greenhouses covered with PE film and PVC sheet (Filclair) and irrigation systems (Irrifrance).
FILCLAIR SA; IRRIFRANCE; TUVEDOC
CHINA; EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE
Accession no.773257

Item 116
Italian Technology
No.1, May 2000, p.232-5
STARCH-BASED FILMS BETTER THAN THE SYNTHETIC ONES
In the sector of starch-based biodegradable materials, Novamont is devoted to the development of new applications and materials with optimised in-use performances and environmental profile. The company is now in the market with materials suitable for flexible films, foams and injection moulded items, commercialised under the Mater-Bi tradename. It is a new generation of bioplastics derived mainly from renewable resources, able to perform as traditional plastics when in use and to completely biodegrade within a composting cycle. This article discusses Mater-Agro film for mulching, Mater-Bag carrier bags, diaper backsheets and compostable bags for the collection of organic waste.
NOVAMONT SPA
EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE
Accession no.772681

Item 117
Polymers for Advanced Technologies
11, No.2, Feb.2000, p.59-68
SWELLING STUDIES OF COPOLYMERIC ACRYLAMIDE/CROTONIC ACID HYDROGELS AS CARRIERS FOR AGRICULTURAL USES
Karadog E; Saraydin D; Caldirian Y; Guven O
Adnan Menderes University; Cumhuriyet,University; Hacettepe,University
Highly swollen acrylamide/crotonic acid hydrogels (in a rod form) containing some inorganic salts such as ammonium nitrate, potassium nitrate and ammonium sulphate used as fertiliser, an agricultural drug such as Dalapon (sodium 2,2-dichloropropionate) and two crosslinkers such as ethylene glycol dimethacrylate and 1,4-butanediol dimethacrylate are prepared by copolymerisation of acrylamide and crotonic acid with gamma-radiation. As a result of swelling tests, the influence of gamma-ray dose and relative content of crotonic acid on the swelling properties, the diffusional behaviour of water, diffusion coefficients and network properties of the hydrogel systems are examined. Acrylamide/crotonic acid hydrogels containing these salts and agricultural drug are swollen in the range 2045-400% in water, while polyacrylamide hydrogels swell in the range 660-700%. Water intake of hydrogels follow a non Fickian-type diffusion. 34 refs.
TURKEY
Accession no.771587

Item 118
Plastics News(USA)
12, No.6, 10th April 2000, p.20
STAND UP LIFTS GARDENING TO THE NEXT LEVEL
Renstrom R
Details are given on a polyethylene vessel used to accommodate a miniature garden. The vessel sits on a wooden base and permits year round gardening. The system has an irrigation system with polypropylene piping and a controller that can be programmed to self-water, based on sensing soil moisture.
STAND UP GARDENS LTD.; HORIZON PLASTICS CO.LTD.; FGL PRECISION WORKS LTD.; ARATO DESIGN
CANADA
Accession no.771376

Item 119
European Plastics News
27, No.4, April 2000, p.25-6
PLAYING THE FIELD
Warmington A
Figures are provided in this article for the consumption of plastics in several European countries, for agricultural and horticultural applications - such as films, irrigation tubing, and rigid pipes. The information comes from the International Committee on Plastics in Agriculture.
AMI; INTERNATIONAL COMMITTEE ON PLASTICS IN AGRICULTURE; EIFEL; PATI; GRUPO ARMANDO ALVAREZ; ALFAGRAIN;
DEGRADABLE PLASTIC FILMS FOR AGRICULTURAL APPLICATIONS IN TAIWAN
Shaw-rong Yang; Chin-hsiang Wu
Tainan District Agricultural Improvement Station; USI Far East Corp.

Results are presented of studies conducted in Taiwan of the use of photo-/biodegradable PE films for mulching horticultural crops. Specific aspects examined included effect of the various mulching films on the yield and quality of melon crops, effect of the degradable PE debris on the yield and quality of subsequent crops, effect of various amounts of degradable PE debris of the growth, yield and heavy metal contents of rice plants, degradation rate at different mulching dates, and weight losses of biodegradable films in pot trials. 14 refs. (5th International Scientific Workshop on Biodegradable Plastics and Polymers, “Degradability, Renewability and Recycling - Key Functions for Future Materials”, Stockholm, Sweden, June 1998)

PREVENTING SOIL EROSION WITH POLYMER ADDITIVES
Orts W J; Sojka R E; Glenn G M; Gross R A
USDA-ARS; Brooklyn, Polytechnic University

The use of polyacrylamide as an irrigation water additive and some of its functional properties, which make it suitable for reducing soil erosion and improving soil infiltration, are discussed. Environmental issues relating to polyacrylamide in irrigation water are considered and potential alternatives to polyacrylamide for agricultural applications are examined. These alternatives include polysaccharide, cellulose, starch xanthate, cellulose microfibrils and chitosan. Finally, future applications of polymers for controlling soil erosion are considered. 54 refs.

UTILIZATION OF POLYETHYLENE AND PARAFFIN WAXES AS CONTROLLED DELIVERY SYSTEMS FOR DIFFERENT FERTILIZERS
Al-Zahrani S M
King Saud University

Paraffin and PE waxes were shown to be efficient as controlled delivery systems for six different commercial-grade fertilisers (monoammonium phosphate, diammonium phosphate, NP, NPK-4 and NPK-14 grades, and granular triple superphosphate fertilisers). Dissolution tests were performed for matrix-type formulations in order to determine the influence of waxes on the fertiliser release rate. Three different diffusion release formulations were tested for describing the release rate of the different fertilisers. The release times were at least doubled for all of the fertilisers while using either paraffin wax or PE wax. The PE wax gave longer release times than the paraffin wax. 19 refs.

NOVEL FINE PARTICULATE SYNTHETIC CHALCOALUMITE COMPOUNDS, PROCESS FOR THEIR PRODUCTION, AND HEAT INSULATOR AND AGRICULTURAL FILM CONTAINING THE FINE PARTICULATE
SYNTHETIC CHALCOALUMITE COMPOUNDS
Takahashi H; Okada A
Kyowa Chemical Industry Co.Ltd.

The fine particulate synthetic chalcoalumite has a given formula, an average secondary particle diameter of not more than about 3 micrometers and a BET specific surface area of not more than about 30 sq.m/g.
EUROPEAN COMMUNITY; EUROPEAN UNION; JAPAN;
WESTERN EUROPE-GENERAL
Accession no.762934

Item 125
Prague, 27th-19th Oct.1999, paper 17, pp.9

TOTA LLY DEGRADABLE POLYOLEFIN PRODUCTS
Tung J F; Wiles D M; Cermak B E; Gho J G; Hare C W J
EPI Environmental Products Inc.; EPI (Europe) Ltd.
(RAPRA Technology Ltd.)

A family of totally degradable film products which are based on conventional PE (LLDPE, LDPE, HDPE) modified with additives (TDPA or Totally Degradable Plastic Additives technology from EPI Environmental Products Inc.) has been successfully developed and commercialised. This novel technology ensures the controlled molecular weight reduction of the products after their use-life is completed. Processability, properties and applications of the degradable PE products, e.g. landfill covers, compost and refuse sacks (containing DCP Degradable & Compostable Plastics additives from EPI Environmental Products Inc.), agricultural films (containing AGP additives from EPI Environmental Products Inc.) and supermarket checkout bags are discussed. A specific case study of the production of totally degradable HDPE carrier bags is presented, with a focus on materials usage, production economics and end-products performance properties. Finally a progress report is presented on preliminary development of totally degradable PP packaging materials. Data include changes in melt index, tensile properties, seal strength and molecular weight after oven ageing and outdoor exposure. The materials include some that satisfy European directives on food contact materials. 3 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; UK; USA;
WESTERN EUROPE
Accession no.758475

Item 126
ENDS Report
No.297, Oct.1999, p.18

RECYCLING FARM PLASTICS IN WALES

Brief details are given of recycling projects in the UK for the management of waste agricultural plastic films. They include a scheme to recycle agricultural plastic film in Wales called ‘Second Life Plastics’, a composting plant near Bridlington, and an incinerator in Huddersfield.
EUROPEAN COMMUNITY; EUROPEAN UNION; UK;
WESTERN EUROPE
Accession no.755417

Item 127
Plast '21
Nos.82/3, June/July 1999, p.18-9
Spanish

ELF ATOCHEM IN THE SERVICE OF AGRICULTURE

A survey is made of plastics materials and products produced by Elf Atochem and its subsidiaries for use in agriculture and horticulture.
ELF ATOCHEM SA; CELLOPLAST; ALTUMAX;
APPRYL; ALPHACAN SA
EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE;
WESTERN EUROPE
Accession no.752800

Item 128
Plast '21
Nos.82/3, June/July 1999, p.14-7
Spanish

INCREASING CONSUMPTION OF PLASTICS IN AGRICULTURE

Applications of plastics in agriculture and horticulture are examined, with particular reference to uses in greenhouse covering, mulching and soil solarisation, and developments by Repsol Quimica in PE and EVA films and by Bayer and BASF in biodegradable polymers are reviewed. Statistics are presented for Spanish consumption of plastics in agriculture and horticulture in 1996 and 1997.
REPSOL QUIMICA SA; BAYER AG; BASF AG;
FISKARS OY AB
EUROPEAN COMMUNITY; EUROPEAN UNION; FINLAND;
GERMANY; SCANDINAVIA; SPAIN; WESTERN EUROPE
Accession no.752799

Item 129
Polymer Plastics Technology and Engineering
38, No.4, 1999, p.675-711

REVIEW ON CONTROLLED RELEASE OF NITROGEN FERTILISERS THROUGH POLYMERIC MEMBRANE DEVICES
Dave A M; Mehta M H; Aminabhavi T M; Kulkarni A R; Soppimath K S
GSFC Science Foundation; Karnatak University

Consequent to the better understanding of various agrochemicals, their functions during the growth cycles of plants and other aspects concerning economics, environment, etc., controlled-release technology has emerged in the areas of fertilisers, herbicides and...
pesticides. The technology and applications of controlled-release delivery systems concerning agrochemicals and the related technological advances are reviewed with some critical suggestions. Emphasis is placed on inexpensive materials, simpler technologies and statistical evaluation in planning and developing newer systems. The interrelationship between technologies for controlled-release and membrane applications is discussed. 116 refs.

INDIA
Accession no.752292

Item 130
European Plastics News
26, No.9, Oct.1999, p.58
NEW TECHNOLOGY FOR MORE NATURAL-LOOK PLASTIC ITEMS
It is briefly reported that Wilson Colour has been able to provide some specially-developed effects for stone and terracotta look plastic plant pots for Grosfillex and marble-effect flowerpots for MJ Industrie. These effects are made by using a basic colour concentrate together with an additional colour additive that gives the natural-type look.
WILSON COLOUR
EUROPEAN COMMUNITY; EUROPEAN UNION; UK; WESTERN EUROPE
Accession no.749193

Item 131
Plasticulture
No.118, June 1999, p.58-65
English; French
FLORIDA CENTER FOR PLASTICULTURE
Hochmuth G; Cantliffe D; Karchi Z; Secker I
Florida,University; PERI
Trials undertaken by the Florida Center for Plasticulture to evaluate the use of PE film covered high and low tunnels and PE film mulches in the protected cultivation of melons in northern Florida are reported. 4 refs.
FLORIDA,CENTER FOR PLASTICULTURE
ISRAEL; USA
Accession no.745760

Item 132
Plasticulture
No.118, June 1999, p.42-8
English; French
PESTICIDES ON USED AGRICULTURAL PLASTICS
Garthe J W; Janke B L
Pennsylvania,State University
Results are presented of a project undertaken to investigate the levels of residual pesticides present on a range of waste film and rigid plastics products from agricultural and horticultural sources. The sampling procedures and analytical methods used in the study are described, and details are given of the types and quantities of pesticide residues found on the different samples. The significance of the findings to the recycling and reuse of plastics from these sources is briefly examined. 7 refs.
USA
Accession no.745760

Item 133
Journal of Applied Polymer Science
73, No.11, 12th Sept.1999, p.2159-67
PREPARATION AND CHARACTERIZATION OF A BIODEGRADABLE MULCH: PAPER COATED WITH POLYMERIZED VEGETABLE OILS
Shogren R L
US,Dept.of Agriculture
Kraft paper was coated with resins based on vegetable oils and then tested for mechanical properties, rate of biodegradation in soil, and ability to inhibit weed growth. Resins included oxidatively-polymerised linseed oil(LO) and a polyester formed by reaction of epoxidised soybean oil and citric acid(ESO-CA). TS of LO-coated paper was slightly higher than that of uncoated paper, while the TS of ESO-CA coated paper was somewhat lower. EBs were similar for all samples. The rates of weight loss and TS during soil burial decreased in the order uncoated paper, LO coated paper, ESO-CA coated paper. The polymerised oils acted as barriers to penetration of microorganisms to the cellulose fibres. Resin-coated papers inhibited weed growth for more than 10 weeks, while uncoated paper was highly degraded and ineffective by 6 to 9 weeks. 40 refs.
USA
Accession no.744940

Item 134
Plasticulture
No.118, June 1999, p.35-41
English; French
SOIL SOLARIZATION TO ELIMINATE DISEASES FROM GREENHOUSES
Kline W L; Roberts W J; Kania S T; Johnston S A
Cumberland County,Rutgers Cooperative Extension; Rutgers,University; Rutgers Agricultural Research & Extension Center
Soil solarisation with PE films was evaluated as a method for the control of soilborne diseases in heated and unheated greenhouses. Soil temperatures were measured at various depths, and soil samples were collected after solarisation and tested for the microorganism Rhizoctonia solani. 7 refs.
USA
Accession no.742628

Item 135
Plasticulture
No.118, June 1999, p.20-34
English; French
USE OF THERMOFILM-IR SINGLE-LAYER AND DOUBLE-LAYER SOIL SOLARIZATION
TO IMPROVE SOIL HEATING IN A CLOUDY CLIMATE
Stevens C; Khan V A; Wilson M A; Brown J E; Collins D J
Tuskegee, University; Auburn, University; Southeast Missouri, State University
Standard LDPE mulching films and Thermofilm-IR LDPE films (Polyon-Barkai) having improved optical properties and tensile strength were compared in the solarisation of agricultural plots in Alabama. The Thermofilm-IR films showed increased resistance to stretching and puncture by weeds, and were more efficient in trapping and retaining solar heat. When applied to plots sprayed with black latex, these films increased the average maximum soil temperature at 5 cm depth by 5°C compared with the standard films. 20 refs.
POLYON-BARKAI
ISRAEL; USA
Accession no.742627

Item 136
Plasticulture
No.118, June 1999, p.14-9
English; French
USING NON-WOVEN FLOATING COVERS ON SUMMER SQUASH FOR EXCLUSION OF WHITEFLY TRANSMITTED GEMINI VIRUSES
Jensen M H; Valenzuela M; Fangmeier D D
Arizona, University; Sonora, University
Non-woven fabric floating covers were used alone and in combination with black/white and brown PE film mulches in the cultivation of summer squash in Arizona. The effects of these treatments on plant growth and yield, control of weed growth and insects and water use efficiency were investigated. 2 refs.
MEXICO; USA
Accession no.742626

Item 137
Plasticulture
No.118, June 1999, p.6-13
English; French
EFFECT OF PLASTICS MULCH, FLOATING ROW COVER AND MICRO TUNNELS ON INSECT POPULATIONS AND YIELD OF MUSKMELON
Farias J; Orozco M; Perez J
Colima, University; INIFAP
Results are presented of trials undertaken in Mexico to evaluate the effects of different combinations of clear and black PE film mulches, spun bonded PP fabric floating row covers and perforated and non-perforated PE film microtunnels on the growth and yield of muskmelons, and on insect population densities and soil temperatures. 2 refs.
MEXICO
Accession no.742625

Item 138
Macplas
24, No.207, April 1999, p.77-9
Italian
SUPER HEXENES BROADEN THE HORIZONS OF LINEAR POLYETHYLENES
Calvosa L
Polimeri Europa
The properties of Polimeri Europa’s Clearflex linear LDPE resins based on super hexene comonomers are examined and compared with those of octene based resins. Results are presented of studies of the mechanical and optical properties of agricultural and packaging films made from Clearflex resins.
EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE
Accession no.742591

Item 139
Patent Number: US 5910514 A 19990608
SYNTHETIC MULCH
Greenberg L M; Smith J A
Synthetic wood chips are made from rubber particles, such as ground-up tyres, and a colourant, which colours the rubber particles to look like a natural mulch. It is preferable that the mulch looks like wood chips, tree bark or pea gravel.
USA
Accession no.741223

Item 140
Plasticulture
No.117, Jan.1999, p.32-40
English; French
NEW POLYOLEFINS FOR ADVANCED USE IN AGRICULTURE
Galli P
Montell Technology
Following a brief examination of the early development of polyolefins and plastics in general, a review is made of agricultural and horticultural applications of polyolefins, with particular reference to materials developed by Montell. Statistics are presented for world production and West European consumption of polyolefins and other commodity polymers. 6 refs.
MONTELL POLYOLEFINS
EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE; WESTERN EUROPE-GENERAL; WORLD
Accession no.740615

Item 141
Plasticulture
No.117, Jan.1999, p.25-31
English; French
TECHNOLOGICAL AND LEGISLATIVE UPDATING FOR PLASTICS MATERIALS USED IN AGRICULTURE
Applications of plastics in agriculture and horticulture and technical and environmental requirements for products used in these sectors are examined. Italian standards relating to the use of plastics in these applications are reviewed, and statistics are presented for Italian, West European and world consumption of plastics in agriculture in 1995.

**Item 142**

**Plasticulture**

No. 117, Jan. 1999, p. 19-24

English; French

**ENVIRONMENTAL IMPACT, DISPOSAL AND RECYCLING OF POST-CONSUMER PLASTICS**

Venosta C

Istituto Italiano dei Plastici

The environmental impact of plastics in agriculture is discussed, and incineration and mechanical recycling techniques for the treatment of agricultural waste are examined. Statistics show West European recycling of plastics in general in 1993 and of plastics waste from the agricultural sector in 1994.

**Accession no. 740613**

**Item 143**

**Plasticulture**

No. 117, Jan. 1999, p. 12-7

English; French

**STRAWBERRIES IN CHINA**

Nuyten H

The development of strawberry cultivation in China both outdoors and in PE film covered greenhouses and tunnels is examined.

**Accession no. 740612**

**Item 144**

**Plasticulture**

Patent Number: US 5804112 A 19980908

**METHOD OF CO-EXTRUDING A BLOWN-FILM TEXTURED LINER**

Greene J D

Olympic General Corp.

A co-extrusion method is claimed for making a blown-film textured liner having a textured surface to provide improved soil gripping properties and smooth untextured edges for improving the integrity of the joint between adjacent liner sheets.

**Accession no. 740149**

**Item 145**

**Modern Plastics International**

29, No. 7, July 1999, p. 64-5

**AGRICULTURAL FILMS OFFER GROWERS A HORN OF PLENTY**

Leaversuch R D

Agricultural films, mostly PE, have long extended farmers’ abilities to protect crops, conserve water and deter weeds. Kool-Lite 380, a Klerk multilayer greenhouse film, uses a reflective pigment to block green light, while absorbing photosynthetic active radiation light which spurs growth. Ampacet offers a silver masterbatch to foster growth and reduce pests like white aphid. Metallocene PE and high-barrier coextruded films are available for fumigation film. Solarisation films generate heat, raise soil temperature and thereby sterilise soils.

**Accession no. 737463**

**Item 146**

**Plasticulture**

No. 116, 1998, p. 43-54

English; French

**USE OF REFLECTIVE FILMS TO IMPROVE THE RED COLOURATION OF APPLES**

Andris H L; Crisosto C H; Grossman Y L

California, University; Beloit, College

Reflective aluminium foils and metallised PP films were laid on the soil between rows of apple trees to investigate their effect on red colour development of the apples. Both materials reflected 52% or more incident light at all wavelengths, with the aluminium foil having an average full spectrum reflectance of 95% and the PP film an average of 63%. Both treatments resulted in enhanced...
colour development without adversely affecting fruit quality. 13 refs.
USA
Accession no.736281

**Item 148**

*Plasticulture*

No.116, 1998, p.16-26

English; French

**CULTIVATION OF PEPPERS USING PLASTICS MULCH WITH COLOURED FILMS AND NUTRIENT IRRIGATION**

Flores J; Ibarra L

Centro de Investigacion en Quimica Aplicada

A study was made of the effects of blue, green and black PE mulching films and nutrient feed levels on the development and yield of peppers cultivated in Mexico. The best results were obtained with blue films due to their influence on the reflection of photosynthetically active radiation and increased soil temperatures. 11 refs.
MEXICO
Accession no.736279

**Item 149**

*Macplas*

23, No.204, Dec.1998, p.73-5

Italian

**INNOVATIVE PS FOAM PACKAGING FOR THE HORTICULTURAL SECTOR**

Ceppi G

Domus Academy

The properties of wood, cardboard and HDPE as materials for fruit and vegetable packaging are examined, and the technical and environmental advantages of using PS foam in this application are discussed.
EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE
Accession no.736231

**Item 150**

*High Performance Textiles*

June 1999, p.6

**REFLECTIVE MAT HELPS GRAPES GROW BETTER**

A mat that reflects solar radiation back up from the ground is being used by French wine-makers to help ripen their grapes. The mat is made by knitting a fabric with a weft inlay of aluminium strips which reflect the sunlight. The strips are held in position by PE yarns which do not rot and are sufficiently strong to permit mechanical traffic to roll over the mat.

MDB TEXINVOX

EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE
Accession no.734190

**Item 151**

*Polymer Engineering and Science*

39, No.3, March 1999, p.399-405

**CONTROLLED RELEASE PVC MEMBRANES: INFLUENCE OF PHTHALATE PLASTICISERS ON THEIR TENSILE PROPERTIES AND PERFORMANCE**

Donempudi S; Yaseen M

Indian Institute of Chemical Technology

Details are given of the preparation of PVC membranes containing dialkylphthalate. The tensile strength and percent elongation of these membranes as a function of concentration of the phthalate plasticisers, their size and ageing period were performed. Applications in the controlled release of agrochemicals are mentioned. 19 refs.
INDIA
Accession no.729119

**Item 152**

*Materials World*

7, No.3, March 1999, p.135-6

**PLASTICS REFUSE TO DEGRADE QUICKLY**

Hill S

Symphony Environmental is producing fully degradable bin bags, carrier bags and other plastic bags from PE, using new additive technology to reduce the plastic to carbon dioxide and water in just a few weeks. SPI-TEK can be engineered to degrade in as little as 60 days or as long as 5-6 years depending on the application. Bayer is currently testing a new polyesteramide biodegradable plastic, BAK 1095, which is claimed to be 100% biodegradable and recyclable.

SYMPHONY ENVIRONMENTAL LTD.; BAYER AG EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; UK; WESTERN EUROPE
Accession no.718643

**Item 153**

*Kunststoffe Synthetics*

No.12, 1994, p.22

German

**TO THE RESCUE OF COMMUNAL COMPOSTING SITES - A COMPLETELY DEGRADABLE PLASTIC FILM FROM BIOTEC**

Wacker M

A biodegradable plastic film produced by Biotec, a daughter company of Melitta, is based on plant starch obtainable from e.g. potatoes, which on degrading leaves only water, carbon dioxide and biomass as in other natural materials. The film can be used to make carrier-bags, packaging film or sheets for horticulture or agricultural applications. Articles from this journal can be requested for translation by subscribers to the Rapra produced International Polymer Science and Technology.

BIOTEC
SWITZERLAND; WESTERN EUROPE
Accession no.716856
STANDARD TESTING METHODS FOR MECHANICAL PROPERTIES AND DEGRADATION OF LOW DENSITY POLYETHYLENE (LDPE) FILMS USED AS GREENHOUSE COVERING MATERIALS: A CRITICAL EVALUATION

Dilara P A; Briassoulis D
Bari, University; Athens, Agricultural University

LDPE films are currently the most widespread greenhouse covering material in the countries of the Mediterranean region. Taking into account the size of this market, the effect of the material performance on the greenhouse production as well as the related environmental impact problems arising from its disposal, the standardisation of the testing of these materials should already have been achieved. However, there are no standard methods available in the European Union for testing LDPE greenhouse films. Furthermore, for predicting the useful lifetime of such films, both the critical effect of the various climatic conditions and the effect of the harsh greenhouse micro-environment on their properties should be taken into account. The various methods for testing the mechanical properties of greenhouse PE films are presented and discussed critically. Also, the factors affecting ageing of LDPE used as greenhouse covering are presented, including methods for inducing ageing and testing methods in order to probe ageing. 42 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GREECE; ITALY; WESTERN EUROPE

ACCESSION NO. 710641

PHOTOSELECTIVE ANTI-INFESTATION FILMS FOR GREENHOUSE COVERING

Espi E; Salmeron A; Tamayo C; Ortiz M L; Laborda F
Repsol SA; Alcala de Henares, Universidad

Results are presented of trials undertaken to evaluate the use of UV blocking PE greenhouse covering films in controlling the development of the pathogen Botrytis cinerea in tomato plants. 15 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE

ACCESSION NO. 710640

NEW INTERFERENCE FILM FOR CLIMATE CONTROL

Verlodt I; Verschaeren P
Hyplast NV

The composition and performance of Kool Lite Plus interference films developed by Hyplast and Klerk’s for horticultural use are examined. These films contain a pearlescent pigment developed by Merck, and which is designed to reflect solar heat without adversely affecting the transmission of photosynthetically active radiation. Results are presented of trials undertaken in southern Tunisia in which these films were used to cover tunnel greenhouses for tomato cultivation. 7 refs.

KLERK’S PLASTIC INDUSTRIE BV; MERCK KGAA
BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; TUNISIA; WESTERN EUROPE

ACCESSION NO. 710639

PRODUCTIVITY OF SOIL SEALED PLASTICS STRUCTURES

Newton P; Ramos S; Burton W R
Manchester, University

Two varieties of spinach producing plants were grown in greenhouses covered with PE films, the edges of which were buried in the soil in an attempt to increase water use efficiency. The trials were undertaken in the UK and in southern Spain in order to assess the effects on plant growth of a range of temperature and solar radiation conditions. 13 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; UK; WESTERN EUROPE

ACCESSION NO. 710638
INVESTIGATION OF THE PHOTOSTABILITY OF DIFFERENT TYPES OF LUMINOphores IN POLYETHYLENE FILMS
Kasa I; Tury G; Kelemen O; Vig A; Vabrik R
Budapest, Technical University; Qualiplastic Co.;
Hungarian Academy of Sciences

Natural and artificial ageing studies were carried out to evaluate the photostability of luminophores added to LDPE film greenhouse coverings to modify the spectral content of incident light according to the needs of photosynthesis. The luminophores studied included a blue emitting organic molecular luminescent model compound, a red emitting europium complex containing organic ligands, and a red emitting inorganic crystalline phosphor activated with europium. 16 refs.

EASTERN EUROPE; HUNGARY
Accession no. 710638

IMPROVING THE PROPERTIES OF POLYETHYLENE FILMS FOR AGRICULTURAL USE
Ashkenazi Y
Polyon Barkai Industries Ltd.

An examination is made of properties of PE films of importance to their use as greenhouse coverings, including thermal and optical properties, surface wettability and resistance to photooxidative degradation. Techniques used to improve such properties are reviewed. 6 refs.

ISRAEL
Accession no. 710637

PHOTODEGRADABLE FILMS FOR AGRICULTURAL MULCHING
Fraga L M; Fontan E; Collar E P; Catalina F
Repsol SA; Instituto de Ciencia y Tecnologia de Polímeros

A review is made of methods for promoting photodegradation in polymers, including the introduction of photosensitive functional groups and incorporation of photosensitive additives. The degradation mechanisms of PE and the morphological properties and photodegradation behaviour of linear LDPE/styrene-butadiene-styrene block copolymer blends for use in mulching films are examined. These blends gave films with improved mechanical properties and controlled photodegradation. Studies showed a clear relationship between butadiene content and the mechanism and rate of photooxidation. The complete breakdown of the material was evidenced by loss of tensile properties, formation and photolysis of hydroperoxide and carbonyl groups, crosslinking and chain scission reactions and the disappearance of unsaturation. 52 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE
Accession no. 710601

Item 162
Plasticheskie Massy (USSR)
No.1, 1996, p.23-4
Russian
CHARACTERISTICS OF AGEING UNDER ULTRAVIOLET IRRADIATION OF PHOTOSTABILISED LOW-DENSITY POLYETHYLENE IN THE PRESENCE OF ORGANOSILICON COMPOUNDS
Almaeva L S; Gorodetskaya N N; Rakova V G; Lebedeva E D

The combined use of organosilicon liquid and photostabiliser Benzon AO makes it possible to increase the photostability of LDPE films by 100%, reduce the amount of photostabiliser by 30-50% and to obtain agricultural films with high strength and high transmission of near-UV radiation, giving increased yields of fruit crops. 7 refs. Articles from this journal can be requested for translation by subscribers to the Rapra produced International Polymer Science and Technology.

RUSSIA
Accession no. 710129

Main Trends in Agricultural Plastics Applications
Gyimesi Gy; Szabo A

The factors underlying the variation in the consumption of plastics from country to country are discussed, and information is given on plastics that can be used in agricultural applications in Mediterranean and Hungarian climatic conditions. A large range of plastics is noted as being used in packaging, storing and transport (animal husbandry). 1 ref. Articles from this journal can be requested for translation by subscribers to the Rapra produced International Polymer Science and Technology.

EASTERN EUROPE; HUNGARY
Accession no. 710037

USE OF PLASTICS MULCH FOR PINEAPPLE CULTIVATION
Rebolledo M C A; Uriza D E; Rebolledo L
INIFAP
Results are presented of trials carried out in Mexico in pineapple cultivation using black and coloured plastics film mulches. The use of black mulch on inclined beds gave considerably improved yields compared with cultivation on flat beds and in the absence of mulch. The mulch also gave fruit with a higher sugar content. 13 refs.  

MEXICO  

Accession no.706073

Item 165  
Plasticulture  
No.114, 1997, p.34-44  
English; French  
CONTROL OF CONDENSATION IN GREENHOUSES BY THE USE OF NON-DRIP FILMS  
Lagier J  
Institut National de la Recherche Agronomique  
Results are presented of studies of the cultivation of lettuce and tomatoes in greenhouses covered with LDPE and EVA films, with and without anti-drip agents to reduce the effects of condensation dripping onto the plants.  
EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE  
Accession no.706072

Item 166  
Plast' 21  
Nos.67/8, Jan./Feb.1998, p.75-6  
Spanish  
SPECIAL POLYMERS FOR AGRICULTURAL APPLICATIONS  
Cobos J J  
Repsol Quimica SA  
Polymers developed by Repsol Quimica for use in agricultural and horticultural applications are examined. These include CP-129 PE used in films for soil disinfection and CP-636 and CP-638 EVA copolymers used in mulching films for asparagus cultivation.  
EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE  
Accession no.706068

Item 167  
European Plastics News  
25, No.10, Nov.1998, p.70  
PROLONGING GREENHOUSE FILM LIFE  
Plastika Kritis has introduced its new UV stabiliser masterbatch range for greenhouse films, it is briefly reported. The range consists of a package of selected hindered amine light stabilisers, processing stabilisers and costabilisers, which increase the resistance of HALS to pesticides.  
PLASTIKA KRITIS  
EUROPEAN COMMUNITY; EUROPEAN UNION; GREECE; WESTERN EUROPE  
Accession no.700584

Item 168  
Journal of Macromolecular Science C  
38, No.3, 1998, p.365-90  
RECENT ADVANCES IN CONTROLLED RELEASE OF AGROCHEMICALS  
Kenawy E R  
Tanta,University  
A review of the literature on recent developments in controlled release of agrochemicals is presented. Particular attention is paid to advantages of controlled release technology, limits of controlled release technology, methods of achieving controlled release formulations for agrochemicals, examples of controlled release formulations of agrochemicals, and future trends. 97 refs.  
EGYPT  
Accession no.695491

Item 169  
Patent Number: EP 861870 A1 19980902  
LONG DURATION EFFECT ANTIDRIPPING FILMS  
Espi Guzman E; Jorge Tapia G  
Repsol Quimica SA  
These films, which are particularly useful as greenhouse and cultivation tunnel covers, are made from an olefin polymer or copolymer and contain a non-ionic surfactant, which provides antidripping properties to the film, which has previously been absorbed in a micronised and microporous mineral load and thus retains the surfactant and acts as a titration element for the surfactant, substantially increasing the film’s antidripping effect, even throughout its service life. The film may be a standard or thermic film, either single or multilayered, made by coextrusion. In this case, at least the external laying facing inwards into the greenhouse, where condensation of the water vapour takes place, must be fabricated with the material according to the invention.  
EUROPEAN COMMUNITY; EUROPEAN UNION; SPAIN; WESTERN EUROPE  
Accession no.695229

Item 170  
Patent Number: US 5735982 A 19980407  
EROSION CONTROL BLANKET AND METHOD OF MANUFACTURE  
Prunty T; Johnson W E; Johnson J W  
American Excelsior Co.  
An environmentally friendly, biodegradable vegetation growth-enhancing erosion control blanket is formed from an elongated rectangular excelsior/wood wool mat, which is held together with adhesive. A surface pattern is embossed in the mat, which shields the earth from wind and water erosion forces and decomposes to provide ground vegetation with a nutritive mulch.  
USA  
Accession no.693437
Item 171
Patent Number: US 5672353 A 19970930
STABILISED AGCHEMICAL CONCENTRATE AND USE THEREOF
Narayanan K S
ISP Investments Inc.

The present invention relates to the stabilisation of an agricultural chemical concentrate in aqueous solution and the stabilised concentrate which comprises: (a) between about 0.1 and about 20 wt.% of a stabiliser composition comprising: (1) a C1 to C12 alkyl vinyl ether/organic acid ester copolymer and (2) a polymer solubilising amount of an aromatic petroleum distillate or an oxygen-containing solvent of an N-alkyl pyrrolidone, a C3 to C8 alkanol, a dibasic acid lower alkyl ester, an ether having a boiling point above 150 deg C or mixtures thereof and (b) between about 80 and about 99.9 wt.% concentrate containing a water-insoluble active agricultural chemical, a solvent for said agricultural chemical and a surfactant for said concentrate. The invention also relates to the use of said stabilised concentrate.

USA
Accession no.687309

Item 172
Polymer Degradation and Stability
60, No.1, 1998, p.79-84
STUDIES ON BIODEGRADATION OF LDPE - OBSERVATION OF LDPE FILMS SCATTERED IN AGRICULTURAL FIELDS OR IN GARDEN SOIL
Ohtake Y; Kobayashi T; Asabe H; Murakami N
Japan, Chemicals Inspection & Testing Inst.; Hagihara Industries Inc.; Takenaka Co.

Low density polyethylene (LDPE) agricultural mulch films, scattered in the ground, were investigated using scanning electron microscopy, Fourier transform infrared spectroscopy (FT-IR) and optical microscopy after staining with lactophenol blue. There were many small holes in the films, and the buried parts were whitened. FT-IR analysis showed carbon-carbon double bonds round the surface of the whitened part, as well as peroxide and hydroxide absorption bands. Optical microscopy showed that bioactivity at the film surface was especially high in the vicinity of the holes, where several colonies of microbes were observed. It was concluded that the biodegradation of thin LDPE film in soil was enhanced by the synergistic action of oxidative and/or photo-oxidative degradation on biological activity, probably due to the increased hydrophilicity of the film surface. 7 refs.

JAPAN
Accession no.687309

Item 173
Plasticulture
No.113, 1997, p.21-5
English; French
WHY GREENHOUSES IN THE TROPICS?
von Zabeltitz C
Hannover, Universitat

The use of greenhouses with cheap wooden frames and plastics film or net coverings for crop protection in tropical climates is discussed. A number of such structures developed in the Seychelles are described. 1 ref.
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; SEYCHELLES; SOUTH EAST ASIA; VIETNAM; WESTERN EUROPE
Accession no.686326

Item 174
Plasticulture
No.113, 1997, p.11-9
English; French
PHOTODEGRADABLE AND PHOTOBIODEGRADABLE FILMS FOR MULCHING MELONS
Quezada R; Munguia J; Sanchez S; Faz R
Centro de Investigacion en Quimica Aplicada; INIFAP-CELALA

Photodegradable and photobiodegradable black and transparent PE films were evaluated in comparison with black and transparent non-degradable PE films as mulches for melon cultivation in Mexico. All the films, and particularly the transparent ones, gave improved yields and quality compared with an unmulched control plot. The photodegradable films degraded more rapidly than the photobiodegradable films, and the black films more rapidly than the transparent ones. 12 refs.
MEXICO
Accession no.686325

Item 175
Plasticulture
No.113, 1997, p.2-10
English; French
FOAMED FILM: A NEW COVERING MATERIAL
Magnani G; Falleri F; Vedrani G
Pisa, University; Polimeri Europa

Foamed EVA films obtained by the generation of gas during the extrusion process were evaluated in comparison with standard EVA films as coverings for tunnel greenhouses for the cultivation of gillyflowers. The foamed films showed higher absorption of long IR radiation and greater diffusion in the visible spectrum and for short IR radiation. As a result, the increase in air temperature in the tunnels was reduced in the daytime, while the differences in air temperatures in tunnels covered with both materials were less significant at night. Plants grown under the foamed films flowered earlier and were of higher quality. 6 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE
Accession no.686324
Item 176

Kunststoffe Plast Europe

STABILISATION OF AGRICULTURAL PLASTIC FILM
Lichtblau A; Zaeh M
Clariant GmbH

The use of application-oriented hindered amine light stabilisers in agricultural films is discussed. The choice of stabiliser in this particular application has to take into consideration the effect on the plastic of agrochemicals and the need to maintain optical and mechanical properties. Examples are given of developments in HALS stabilisers which are claimed to offer advantages for agricultural applications. 9 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.679102

Item 177

Plasticulture
No.112, 1996, p.46-50
English; French

HORTICULTURAL POTS MADE FROM BIODEGRADABLE MATERIALS
Groot L
Institut fuer Technik in Gartenbau und Landwirtschaft

The use of biodegradable materials, particularly paper, in plant pots and other horticultural containers is examined, and properties of plastics, paper and starch pots are compared. Results are presented of trials which showed the increased energy requirements arising from higher water consumption by paper pots, and the possibility of reducing evaporation rates by coating the pots with various biodegradable materials including latex and natural resins is discussed. 3 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.679104

Item 178

Plasticulture
No.112, 1996, p.23-31
English; French

CONденSATION AND PAR TRANSMITTANCE OF GREENHOUSES
Pieters J G
Ghent,University

Estimates were made of the effects of condensation as a film and as droplets with contact angles of 30, 60 and 90 degrees on the transmission of photosynthetically active radiation (PAR) by PE greenhouse covering films. Film condensation was found to increase the average annual transmission by about 2.6% compared to the dry state, while droplets decreased the transmission by as much as 15%. Condensation slightly enhanced the positive effect of an east-west orientation of the greenhouse ridge compared to a north-south orientation, and it reduced the negative effect of a large incline angle of the roof. 12 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE
Accession no.679102

Item 179

Plasticulture
No.112, 1996, p.21-2
English; French

USE OF COLOURED PLASTICS TO REDUCE THE INCIDENCE OF TOMATO YELLOW LEAF CURL VIRUS IN MARKET TOMATOES
Lutinsky U; Hama M; Roso R
Neot Golan

Yellow/brown and silver/black coextruded mulching films were evaluated as a means for reducing yellow leaf curl virus in tomatoes. The yellow/brown films delayed the incidence of the virus, especially when used in combination with an imidaclotide pesticide, while also keeping the soil cool and preventing weed growth.

ISRAEL
Accession no.679104

Item 180

Plasticulture
No.112, 1996, p.15-20
English; French

EFFECTS OF UV BLOCKING GREENHOUSE COVERS ON INSECTS AND INSECT-BORNE VIRUS DISEASES
Antignus Y; Cohen S; Mor N; Masika Y; Lapidot M
Volcani Center; Tel Aviv,Field Extension Service

Results are presented of a study of the effectiveness of UV absorbing PVC netting and PE and PVC films in controlling insect infestation in greenhouses used in the cultivation of tomatoes and cucumbers. 6 refs.

GINEGAR PLASTIC PRODUCTS; POLYON-BARKAI; EREZ THERMOPLASTIC PRODUCTS
ISRAEL
Accession no.679103

Item 181

Plasticulture
No.112, 1996, p.3-14
English; French

REVIEW OF THE PLASTICS INDUSTRY AND PLASTICULTURE IN ISRAEL
Goren M; Gazit M
Carmel Olefins Ltd.

Agricultural and horticultural applications of plastics in Israel are reviewed, with particular reference to
developments in coverings for greenhouses and other structures, irrigation pipes and fittings, photodegradable and fluorescent films, and films for use in preventing the blackening of rose petals. The structure of the Israeli plastics industry is examined, and statistics are presented for plastics consumption and exports.

ISRAEL; WORLD
Accession no.679099

Item 182
Polylefins X. Conference proceedings.
STABILISATION OF AGRICULTURAL FILMS: PAST, PRESENT AND FUTURE
Guo M; Horsey D; Lelli N; Bonora M
Ciba-Geigy Corp.; Ciba-Geigy Ltd.
(SPE,South Texas Section; SPE,Thermoplastic Materials & Foams Div.)
Agricultural films must resist weathering due to sunlight, but have the additional requirement of chemical resistance. An evolution of stabilisers is ongoing for all polyolefins and is especially evident in the agricultural film market. Historically, nickel quenchers and benzophenone UV absorbers have been used to protect films from UV degradation. As nickel quenchers are being phased out of the market for environmental reasons, new stabilisers need to be developed. Hindered amine light stabilisers (HALS) systems based on tertiary HALS now offer an efficient approach to UV stabilisation and have replaced nickel quenchers and UV absorbers in many applications. Highly efficient chemical resistant light stabiliser systems have been developed with high molecular weight tertiary HALS and co-additives. It is forecast that market needs for longer lived greenhouses and thinner mulch films will require even more powerful stabilisers. New non-interacting chemistries based on alkoxyamine HALS offer the next generation of stabilisers for agricultural films. 11 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; SWITZERLAND; USA; WESTERN EUROPE
Accession no.674893

Item 183
European Plastics News
POLIMERI EUROPA
Polimeri Europa has improved the optical properties of its Biblene FF 29 LDPE grade for agricultural applications. The grade, which has a melt index of 0.6 and a density of 0.921g/cm3, has increased gloss and decreased haze over the original product. These optical improvements are achieved by increasing the reaction pressure during processing. The main end use of this grade is greenhouse film for Italian customers. This abstract includes all the information contained in the original article.
POLIMERI EUROPA
EUROPEAN COMMUNITY; EUROPEAN UNION; ITALY; WESTERN EUROPE
Accession no.668175

Item 184
Plasticulture
No.111, 1996, p.36-42
English; French
USE OF POLYCHROMATIC POLYPROPYLENE FILMS FOR GREENHOUSES IN LETTUCE CULTIVATION
Lozano M J; Gonzalez M C; Gonzalez E A
Centro de Investigacion en Quimica Aplicada
PP films containing UV stabilisers and photochromic additives were evaluated as greenhouse coverings for lettuce cultivation. The mechanical and optical properties and ageing characteristics of the films and the biological properties of the lettuce were investigated. The results showed good mechanical and optical properties and increased transparency to photosynthetically active radiation, and crop yields were increased by around 17%. However, accelerated ageing studies suggested that these films could not be recommended for use in greenhouse covering. 9 refs.
MEXICO
Accession no.663544

Item 185
Plasticulture
No.111, 1996, p.23-33
English; French
EVALUATION OF THE NON-DRIP PROPERTIES OF GREENHOUSE CLADDING FILMS
Schultz W; Bartnig K H
Hannover,Institute of Horticultural Engineering; Constab Polymer-Chemie GmbH
Results are presented of a study of the effects of condensation on the light transmission of various standard and non-drip plastics greenhouse covering films. Measurements of light transmission with increasing condensation from the dry to the wet state and studies of dripping characteristics showed the advantages of non-drip films. Preliminary studies of single droplets showed that droplet size and shape were influenced by the surface properties of the film and by roof slope, and that it was not possible to determine one typical contact angle for a given film. 15 refs.
EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.663543

Item 186
Addcon Asia ’97. Conference proceedings.
NEW DEVELOPMENTS IN AGROFILMS STABILISATION
Grabandt M; Lelli N; Gugumus F
Ciba Specialty Chemicals (Singapore) Pte.Ltd.; Ciba Specialty Chemicals Inc.
(Rapra Technology Ltd.)
Agrofilms, e.g. greenhouse, small tunnels, mulch and silage PE films, are widely used to optimise agricultural production. Many parameters affect the durability of the agrofilm. One of the most important is the type and concentration of stabilisers selected. Another important factor is the abundant use of agrochemicals on crops (i.e. active molecules, dosage, frequency). Agrochemicals, especially those containing sulphur and halogens, are known to negatively affect the durability of the film by sensitising photodegradation of the agricultural film and by interacting with the light stabilisers. Emphasis is placed on new HALS-based stabilisers specifically developed for pesticide resistance giving enhanced agricultural film durability. 14 refs.

SINGAPORE; SWITZERLAND; WESTERN EUROPE
Accession no.662089

Item 187
Plasticulture
No.110, 1996, p.35-43
English; French
USE OF PLASTICS IN ECOLOGICALLY SOUND VEGETABLE PRODUCTION IN THE OPEN
Benoit F; Ceustermans N
European Vegetable R & D Centre

Ecological aspects of the use of plastics in the protected cultivation of vegetables are discussed. Applications examined include film mulches and direct covers, combinations of these two techniques, and insect screens made of plastics netting. 28 refs.
BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; USA; WESTERN EUROPE; WESTERN EUROPE-GENERAL
Accession no.659599

Item 188
Plasticulture
No.110, 1996, p.29-34
English; French
RECENT DEVELOPMENTS IN EGYPTIAN PLASTICULTURE
El-Aidy F
Kafr-El-Sheikh, Faculty of Agriculture

Developments in the use of plastics covered greenhouses and low tunnels in Egypt are reviewed, and the potential of different regions of the country for protected cultivation is examined. Statistics are presented for Egyptian plastics production. 4 refs.
EGYPT, MINISTRY OF AGRICULTURE; EGYPT, PLASTICS DEVELOPMENT CENTRE; AIN SHAMS, UNIVERSITY
EGYPT
Accession no.659598

Item 189
Plasticulture
No.110, 1996, p.23-8
English; French
GROWING ASPARAGUS UNDER BLACK MULCH FILM

REUSE OF PLASTICS BOXES FOR THE TRANSPORTATION OF FRUIT AND VEGETABLES
Pacini L
Istituto Italiano dei Plastici

An examination is made of developments in the use of reusable plastics containers, particularly rigid and foldable crates, in the transportation of fruits and vegetables in Europe. The objectives of a European Union directive concerning packaging and the environment are described. IFCO EU; EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; ITALY; WESTERN EUROPE; WESTERN EUROPE-GENERAL
Accession no.659597

Item 190
Plasticulture
No.110, 1996, p.2-14
English; French
COVERING MATERIALS TO CONTROL PLANT GROWTH BY MODIFYING THE SPECTRAL BALANCE OF DAYLIGHT
Murakami K; Cui H; Kiyota M; Takemura Y; Oi R; Aiga I
Osaka Prefecture, University; Mitsui Toatsu Chemicals Inc.

A method was developed for changing the red/far red photon flux ratio of natural radiation in greenhouses. PMMA sheet and PETP film were coloured with red and far red intercepting dyes, and the effects of these covering materials on the growth and development of various crops were investigated. 6 refs.
JAPAN
Accession no.659595

Item 191
Plasticulture
No.109, 1996, p.39-49
English; French
PRESENT AND FUTURE OF PROTECTED CULTIVATION OF FRUIT TREES IN JAPAN
Kamota F
Japan, Greenhouse Horticulture Association

The use of plastics covered greenhouses for protected cultivation of fruit trees in Japan is examined, and developments in environmental control and strategies for cost reduction are discussed.
JAPAN
Accession no.659594

Item 192
Plasticulture
No.109, 1996, p.23-30
English; French
GROWING ASPARAGUS UNDER BLACK MULCH FILM
Pfunder H

The use of black PE film mulches in asparagus cultivation in southern Germany is examined. Advantages in terms of increased and earlier yields, weed control and reduced and more constant soil temperatures are discussed.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.659592

Item 193
Plastics News International
Oct. 1997, p.18

WASTE AGRICULTURAL FILM DISPOSAL TRIAL

Brief details are given of a project in the Goulburn Valley of Victoria being sponsored by PACIA to effectively dispose of waste agricultural film. Research has shown that the film could be used as an alternative fuel in a number of regional boilers currently using brown coal briquettes. The aim of the project is to establish a pilot plant which would serve as a reference for the establishment of similar projects in other parts of Australia.

PACIA
AUSTRALIA
Accession no.658385

Item 194
Injection Molding
5, No.9, Sept. 1997, p.62/70

MARKET FOCUS: LAWN AND GARDEN
Sloan J

Developments in lawn and garden injection moulded products are reviewed, and the significant market trends in the industry are discussed. These include soft touch materials, and the introduction of bondable thermoplastic elastomers and thermoplastic vulcanisates. The trend in a preference for liquid cooled lawn and garden engines enables plastics to penetrate previously metal applications, since liquid cooled engines generate less heat. Gas-assist techniques have enabled Capron nylon to be moulded onto handles on lawn and garden equipment, with greater retention of flexural strength and improved impact resistance. Examples are given of such applications where plastics are used.

ALLIEDSIGNAL PLASTICS; AES
USA
Accession no.655627

Item 195
Patent Number: US 5585418 A 19961217
GREENHOUSE FILM HAVING VARIABLE LIGHT DIFFUSION PROPERTIES
Nagata H H
AT Plastics Inc.

A greenhouse assembly comprises, in combination, a greenhouse cover support means and a thermoplastic film cover supported by the cover means. The film has outermost of the assembly a variable light diffuse surface, which is substantially clear when wetted but has an enhanced degree of surface haze when dry. The greenhouse covering provides suitable variable light transmission into the greenhouse dependent on weather conditions.

CANADA
Accession no.651237

Item 196
Patent Number: WO 9530539 A1 19951116
Japanese
AGRICULTURAL ANTIFOGGING FILM
Shimada K; Nakata Y; Watanabe K; Hori Y
Daikin Industries Ltd.

This is prepared by applying corona discharge to at least one side of a specified fluoropolymer film and forming thereon an antifogging layer comprising a modified PVAl having both silyl and ionic hydrophilic groups and silica. The film is wettable with water because of the small angle of contact with water and has excellent transparency and durability due to the improved adhesion between the antifogging layer and fluoropolymer film as the base.

JAPAN
Accession no.634704

Item 197
Scrap Tire News

TYRE CHIPS TESTED AS MULCH FOR SHRUBS, TREES

The article supplies brief details of a study, carried out by two scientists from Georgia University, and funded by the Government from the 1 dollar fee charged on new tyre sales, into whether 2-4 inch tyre chips can be used as mulch for blueberry bushes and Christmas trees. Used in place of pine bark mulch, if the tyre chips are successful and cost-effective, it could open up a market for large quantities of the material. This abstract includes all the information contained in the original article.

GEORGIA, UNIVERSITY
USA
Accession no.632576

Item 198
Geosynthetics International
3, No.6, 1996, p.679-700

FIELD EVALUATION OF PROTECTIVE COVERS FOR LANDFILL GEOMEMBRANE LINER UNDER CONSTRUCTION LOADING
Reddy K R; Bandi S R; Rohr J J; Finy M; Siebken J
Illinois, University; Great Lakes Soil & Environmental Consultants Inc.; Rust Environment & Infrastructure; Waste Management Inc.; National Seal Co.
The performance of landfill geomembrane liner protective cover systems with and without a geotextile was evaluated using field tests. The physical properties of the protective cover soils and the geomembrane liner before and after field testing were determined using laboratory tests. The hydraulic properties of the geomembrane field samples were measured using water vapour transmission tests, and the mechanical properties were measured using multi-axial tension tests and wide strip tensile tests. A low mass per unit area geotextile was demonstrated to completely protect the geomembrane in this study. 12 refs.

USA
Accession no.632422

Item 199
Patent Number: US 5532298 A 19960702
DEGRADABLE AGRICULTURAL MAT
Monroe S H; Goettmann J A; Funk G A
International Paper

A degradable ground cover is composed of HDPE fibre and cellulose pulp, which is 100% photo- and biodegradable and is used in weed control and moisture retention in soil. It lasts 8 to 12 weeks before serious photo- and biodegradability occurs, while allowing crop plants sufficient time to mature and produce and totally disappears with plowing and tilling, becoming a soil extender until complete degradation occurs.

USA
Accession no.625651

Item 200
Patent Number: EP 761427 A1 19970312
POLYOLEFIN RESIN COVERING FILM AND METHOD FOR RAISING PLANTS
Fujita T; Sakaya T; Negawa H; Nakanishi M; Kudo A

The film has a first layer of a polyolefin resin and second and third layers, which are provided on respective sides of the first layer and made of a polyolefin containing 20 wt.% or less of a polar group-containing vinyl monomer, in which the film contains 6 to 50 wt.% of an IR absorber, based on the weight of the covering film, and has an IR absorbance of 70 to 85% at 27°C. The film is preferably used as a covering film for greenhouses or tunnels for horticultural applications.

SUMITOMO CHEMICAL CO.LTD.
JAPAN
Accession no.625380

Item 201
Patent Number: US 5523046 A 19960604
METHOD OF USING A FEMALE TOOL WITH MOVABLE PLATES TO FORM A SHEET MATERIAL INTO A FLOWER POT OR FLOWER POT COVER HAVING OUTWARD FINS
Weder D E; Craig F J; Straeter J G
The family Trust U/T/A; Southpac Trust International Inc.

In an embodiment for forming outwardly extending fins, the apparatus includes a male mould and a plurality of plates arranged in pairs to define a forming opening. The male mould has a plurality of fingers which are laterally extendable from the outer periphery of the male mould. A pneumatic or hydraulic piston and cylinder is provided to move the male mould between a storage position spaced from the forming opening and a forming position within the forming opening. Each pair of plates is movable between an open position and a closed position. In operation, the fingers are extended to push folded portions of a sheet of material between the pairs of plates, which are closed to press the folded portions into fins. In an alternate embodiment for forming outwardly extending fins, pairs of movable plates are positioned between stationary segments. The plates move away from one another to press folded portions of a sheet of material against the adjoining stationary segments to form fins. In another embodiment, a female mould having closable female segments cooperates with blades which are pivotable between the female segments to produce outwardly extending fins. In an apparatus for forming inwardly extending fins, blades are pivoted to push folded portions of a sheet of material between segments of a male mould.

USA
Accession no.623562

Item 202
Polymer Recycling
POLYURETHANE ETHER FOAM (PUR) AN ECOLOGICAL SUBSTRATE FOR SOILLESS GROWING
Benoit F; Ceustermans N
European Vegetable R & D Centre

The advantages of polyether urethane foam are detailed and the PUR substrate is considered in harmony with the basic economic, ecological and ergonomic principles of research philosophy. The PUR substrate costs 60 Belgian francs and is about 20 Belgian francs/mat more expensive than other substrate materials, but the PUR product can be depreciated over 10-15 years. Steam sterilisation costs only half of the recycling or disposal costs of other substrates. 15 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE
Accession no.622311

Item 203
Plasticulture
No.107, 1995, p.21-7
English; French
CONTROL OF NEMATODES AND WEEDS BY SOIL SOLARISATION IN TOBACCO NURSERIES: EFFECT OF THE FILM THICKNESS AND OF THE COVERING
Clear LDPE films of different thicknesses were used for the soil solarisation of tobacco seed beds. The influence of film thickness (100-400 gauge) and period of covering (15-60 days) on nematode and weed control was investigated. 3 refs.

“Smart” agricultural films, the use of which can yield heavier and earlier crops and reduce or eliminate the need for chemical pesticides and herbicides, are to be developed in a joint venture between Ampacet and Kafrit Industries of Israel. Reflective colour additives can increase the size of fruits and cause earlier crop maturation. A method is being perfected to impregnate plastics with an agricultural chemical that is released in a controlled dosage. Research is being conducted into film additives which filter out specific wavelengths essential to the development of mould fungi.

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A survey is made of applications of plastics in windbreaks, mulching, greenhouses and other forms of crop protection in countries bordering the Mediterranean. Types of plastics used and crops grown are examined, and statistics are presented for areas of land covered by plastics in particular countries. 19 refs.

Cabot Plastics has developed the Plasblak range of black masterbatches to provide the opacity, weathering performance and physical properties required of agricultural film. It is briefly reported that the masterbatches offer improved specifications in finished film at reduced addition levels. Applications include mono and multilayer silage sheets, silage bags, mulch film and silage stretch wrap.

A survey is made of agricultural applications of plastics, including mulching, greenhouses and other forms of crop protection, silage and drip irrigation. Some developments in the standardisation and quality control of plastics used in such applications are reviewed, and problems associated with the recycling of waste materials are briefly discussed. Statistics are presented for the consumption of plastics in agriculture in a number of regions and countries.

It is briefly reported that Research Development Corporation of Japan has developed production technology for biodegradable plastic film. The film is made mainly from chitosan and cellulose, with starch added. It will be used in the form of seed-containing tapes/sheets for agriculture and spore bags for layer farming. The 1.2m wide film is produced continuously by an aqueous solution casting method.

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Applications of geotextiles in nurseries for tree and shrub cultivation and in landscape management are described. These include containers for tree and shrub growth, trench linings, bed coverings, sleeves for holding nursery stock, collars serving as barriers to weed growth and as carriers for fertilisers and herbicides, covers for providing protection in winter and shade in summer, guying systems for tree staking, protective wrappings for tree trunks, and systems for root redirection and soil aeration. 8 refs.

ACF ENVIRONMENTAL; DALEN PRODUCTS INC.; REEMAY INC.; DEWITT & CO.INC. USA
Accession no.598426

Item 210
Plasticulture
No.106, 1995, p.15-24
English; French
PHOTODEGRADABLE POLYETHYLENE MULCH FILMS
Sanchez S; Yanez I; Quezada R; Cedillo R
Centro de Investigacion en Quimica Aplicada
A study was made of the natural and artificial ageing behaviour of mulching films made from a blend of LDPE and linear LDPE formulated with an organometallic iron complex as the photodegradable additive and a UV stabiliser. Black films were also produced from blends containing carbon black as pigment. Using the appropriate combination of additives, it was possible to produce films having different induction periods and which would maintain adequate mechanical properties for a predetermined period followed by disintegration. In black films the photodegradant and the carbon black showed a marked antagonistic effect, explaining the lesser stability of black films compared with transparent films at equal levels of photodegradant. 14 refs.
MEXICO
Accession no.598424

Item 211
Indian Journal of Natural Rubber Research
8, No.1, 1995, p.13-20
POLYTHENE MULCHING IN RUBBER SEEDLING NURSERY
Lakshmanan R; Punnoose K I; Mathew M; Mani J; Pothen J
India,Rubber Research Institute
The feasibility of using polythene films as mulch in rubber seedling nursery was investigated. Results are given of field studies conducted with three types of clear films, conventional plant mulch and an unmulched control. The effect of mulching on weed control and soil temperature fluctuations is discussed. 12 refs.
INDIA
Accession no.597004

Item 212
China Rubber Industry
43, No.3, 1996, p.143-7
Chinese
STUDY ON SLOW-RELEASING FERTILISER IN RECLAIM RUBBER MATRIX
Han Huisheng; Ma Xiaobing
Beijing,Research & Design Inst.of Rubber Ind.
A urea-reclaim rubber composite was developed by using reclaimed rubber as matrix. The mixing technology of urea and reclaim rubber and the releasing rate of urea from reclaim rubber matrix was investigated. It was confirmed that the urea-reclaim rubber composite featured a slow-releasing fertiliser. 6 refs.
CHINA
Accession no.586058

Item 213
Plasticulture
No.104, 1994, p.33-46
English; French
LOW TUNNELS COMBINED WITH MULCH: EFFECTS OF DIFFERENT PE FILMS ON THE MICROENVIRONMENT AND YIELD OF TOMATOES
Salinas J C; Pearson S
Guadalajara,University; Reading,University
Tomatoes were cultivated in low tunnels covered with clear and anti-fogging PE films and an EVA film and mulched with a clear LDPE film and a blue thermal film. The influence of these materials on light transmission, air and soil temperatures and tomato yields was studied. 13 refs.
BRITISH VISQUEEN LTD.
EUROPEAN COMMUNITY; EUROPEAN UNION; MEXICO; UK; WESTERN EUROPE
Accession no.583084
Item 215

**Plasticulture**
No.104, 1994, p.4-12
English; French

**PLASTICS FOR HORTICULTURAL USE**
Emmert E M
Kentucky, University

This paper, originally presented at an International Horticultural Congress in 1958, reviews early work on the horticultural applications of plastics conducted at the University of Kentucky. Applications examined include greenhouses, soil mulching, row covers and cloches, heating tubes, soil storage and plant pots. 6 refs.

USA
Accession no.583083

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Item 216

**Materials World**

**POLYMER SEED COATINGS**
The article supplies brief details of Intelimer, a material for agricultural seed coatings, developed by Intellicoat, a subsidiary of Landec Corp. of California. The Intelimer polymer coating exhibits distinct changes in permeability, adhesion and viscosity when heated or cooled to a predetermined temperature. The physical properties of the polymer allow coated seeds to germinate at a pre-set temperature, ensuring precision products are manufactured for plant, animal and human use.

INTELLICOAT; LANDEC CORP.
USA
Accession no.581282

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Item 217

Antec 95. Volume III. Conference proceedings.
Boston, Ma., 7th-11th May 1995, p.3615-9. 012

**STABILISATION OF AGRICULTURE FILMS BY POLYMERIC HALS WITH PARTICULAR EMPHASIS ON POSSIBLE INTERACTIONS WITH AGROCHEMICALS**

Keck-Antoine K
Hoechst AG
(SPE)

Polymeric hindered amine light stabilisers (HALS) are the UV stabilisers of choice for LDPE based films. Despite the knowledge of general correlations, forecast of the service life is difficult due to UV stabiliser-agrochemical interactions. Although mechanism and level of interaction depend on the type of agrochemical, polymer HALS in particular show strong interaction. This phenomenon appears to be product specific for this type of polymeric HALS. 11 refs.

EUROPEAN COMMUNITY; EUROPEAN UNION; GERMANY; WESTERN EUROPE
Accession no.577513

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Item 218

Antec 95. Volume III. Conference proceedings.
Boston, Ma., 7th-11th May 1995, p.3255-9. 012

**PHOTODEGRADATION OF LLDPE AGRICULTURAL FILMS PIGMENTED WITH TITANIUM DIOXIDE**

Tooley P A; Le Q K
DuPont de Nemours E.I., & Co.Inc. (SPE)

Agricultural films composed of stabilised LLDPE and pigmented titanium dioxide grades with different types of surface treatment are evaluated for durability to light. Films are exposed under both outdoor and accelerated conditions. Film degradation is measured by Fourier transform infrared spectroscopy as a function of carbonyl (ketone and carboxylic acid) formation. Results of the study demonstrate that under the same conditions of exposure, pigment surface stabilisation greatly influence the rate of carbonyl formation. 6 refs.

BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; USA; WESTERN EUROPE
Accession no.577449

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Item 219

Patent Number: US 5414030 A 19950509

**AGRICULTURAL FILM**

Kotani K; Sakaya T
Sumitomo Chemical Co.Ltd.

This is made from a composition comprising a polyolefin, a dripping agent, a heat stabiliser, a weather resistance improving agent and a solution of a hypophosphite compound in an organic solvent.

JAPAN
Accession no.571020

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Item 220

Polimery Tworywa Wielkoczasteczkowe
38, No.12, 1993, p.592-6

**MODIFICATION OF LOW-DENSITY POLYETHYLENE(LDPE) FOR THE DEVELOPMENT OF A NEW GENERATION OF AGRICULTURAL FILMS**

Kalfas S; Rymarz G
Gliwice, Institute of Plastics & Paint Industry

Results are presented of the modification of LDPE with aliphatic polyether, glass microspheres, antifogging agent (PPD-92), glycerol monostearate, ethoxylalkyl amine, 2-hydroxy-4-octoxybenzophenone and a sterically hindered amine. The aim of the studies was to develop a new multifunctional agricultural film with improved service properties. The film containing an optimum amount of modifiers was a stable heat-insulating film which exhibited good anti-electrostatic and antifogging properties, high transmittance of visible light responsible for plant growth and high strength properties (tensile
strength above 15 MPa and elongation at break above 400 %). 13 refs. Articles from this journal can be requested for translation by subscribers to the Rapra produced International Polymer Science and Technology.

EASTERN EUROPE; POLAND
Accession no.565977

Item 221
New Materials/Japan
Sept.1995, p.7
FLUORESCENT PIGMENTS AID AGRICULTURAL FILM
It is briefly reported that Nippon Soda has developed fluorescent pigments based on pyrazine compounds which look set to find prominent use in plastics films used in agriculture due to their ability to drastically change the wavelength of sunlight. When added to plastic film the pigments turn UV and visible rays into blue and red light, respectively, thereby promoting photosynthesis of agricultural crops. Tests have confirmed that the products help increase yields, improve crop quality and control harvest times.
NIPPO SODA CO.LTD.
JAPAN
Accession no.560745

Item 222
Patent Number: US 5384183 A 19950124
DEGRADABLE FILMS
Taylor J
Novacor Chemicals Ltd.
Degradable films for agricultural mulch applications are described, which have a controlled life from 30 to 160 days. The film comprises photodegradable sheet material having a thickness from 0.1-10 mm, preferably from 0.2-5.0 mm, and comprising a polyolefin sheet and from 50-1,000 ppm of cerium salt of a C16-C20 fatty acid and from 1,000-2,000 ppm of titanium dioxide having a particle size less than 0.05 microns.
CANADA
Accession no.557220

Item 223
Polymer Degradation and Stability
A32, No.4, 1995, p.775-85
BIODEGRADABLE BLENDS OF CELLULOSE ACETATE AND STARCH. PRODUCTION AND PROPERTIES
Mayer J M; Elion G R; Buchanan C M; Sullivan B K; Pratt S D; Kaplan D L
US,Army Natick Res.Dev.& Engng.Center;
International Communications & Energy; Eastman Chemical Co.; Rhode Island,University
Blends of cellulose acetate (2.5 degree of substitution) and starch were melt processed and evaluated for mechanical properties, biodegradability during composting, and marine and soil toxicity. Formulations containing, on a weight basis, 57% cellulose acetate, 25% corn starch and 19% propylene glycol had mechanical properties similar to PS. Increasing plasticiser or starch content lowered TS. Simulated municipal composting of...
cellulose acetate alone, showed losses of 2-3 and 90% dry weight after 30 and 90 days, respectively. Cellulose acetate/starch/propylene glycol blends in both soil burial and composting experiments indicated that propylene glycol and starch were degraded first. Extended incubations were required to detect losses from cellulose acetate. Marine toxicity tests using polychaete worms and mussels showed no toxicity of cellulose acetate or starch. High doses had an adverse effect due to oxygen depletion in the marine water due to rapid biodegradation of the polymers. Preliminary plant toxicity tests of the cellulose/starch blends showed no negative impact on growth and yield for sweet corn, butternut squash and plum tomatoes. Suitability for injection moulding is indicated. 9 refs. (Presented at Int. Workshop on Controlled Life-Cycle of Polymeric Materials, Stockholm, Sweden, 21st-23rd April 1994).

**Item 226**  
**Polymer Science Series A**  
37, No.1, Jan.1995, p.22-7  
**WATER-SOLUBLE POLYMERIC ESTERS OF CARBOXYL-CONTAINING PLANT GROWTH REGULATORS**  
Shht’man M I; Sarkisyan M B; Tsatsakis A M; Shashkova I M; Mokhalodimitrakis E; Dais F  
Mendeleev University of Chemical Technology; Crete, University  

Polymeric esters of carboxyl-containing regulators of plant growth, 3-indolyl acetic, 3-indolyl butyric, 1-naphthyl acetic, 1-naphthoxy acetic, 2-naphthyl thioacetic, and 2,4-naphthyl phenoxyacetic acids, were prepared by reaction of their potassium salts with the copolymer of acrylamide and vinyl-2-chloroethyl ether in DMSO. The reactivity of the salt increases with a decrease in the strength of the acid. 10 refs.

**EUROPEAN COMMUNITY; EUROPEAN UNION; GREECE; RUSSIA; WESTERN EUROPE**  
Accession no.549587

**Item 227**  
**International Polymer Science and Technology**  
21, No.9, 1994, p.T98-103  
**MODIFICATION OF LOW-DENSITY POLYETHYLENE (LDPE) FOR THE DEVELOPMENT OF A NEW GENERATION OF AGRICULTURAL FILMS**  
Kalafs S; Rymzarz G  

A formulation is proposed which guarantees production of film with thermal insulation properties (IR transmission below 20%), which is effectively stabilised (decrease of relative elongation after 1300 h in the Xenotest to 80%), and at the same time is characterised by very good antistatic properties and antifogging properties, high transmission of visible radiation which is responsible for plant growth and good mechanical properties. 13 refs.  
Translation of Polim.Tworz.Wielk., No.11, 1993, p.592  
**EASTERN EUROPE; POLAND**  
Accession no.541121

**Item 228**  
**Plasticulture**  
No.102, 1994, p.33-40  
**CHARACTERISATION OF THE GREENHOUSE CLIMATE UNDER THERMAL PE FILM IN NORTHERN PORTUGAL**  
Abril A; Rosa E  
Tras-o-Montes e Alto Douro, Universidad  

Results are presented of a five-year study carried out in northern Portugal of temperatures inside greenhouses covered with thermal PE films. 6 refs.  
**EUROPEAN COMMUNITY; EUROPEAN UNION; PORTUGAL; SPAIN; WESTERN EUROPE**  
Accession no.535449

**Item 229**  
**Plasticulture**  
No.102, 1994, p.17-24  
**BARRIER FILMS FOR SOIL FUMIGATION**  
Daponte T L F  
Hyplast NV  

The gas permeability of polymers and structural factors influencing permeability are discussed, with particular reference to multi-layer barrier films for soil fumigation using methyl bromide. 14 refs.  
**BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; WESTERN EUROPE**  
Accession no.535448

**Item 230**  
**Plasticulture**  
No.102, 1994, p.7-16  
**DEVELOPMENT OF PHOTOSELECTIVE PE FILMS FOR CONTROL OF FOLIAR PATHOGENS IN GREENHOUSE GROWN CROPS**  
Reuveni R; Raviv M; Bar R; Ben-Efraim Y; Assenhaim D; Schnitzer M  
Israel, Agricultural Research Organisation; Ginegar Plastics Products  

Microclimatic factors responsible for disease in greenhouse grown plants are reviewed, and the use of photosensitive PE films as greenhouse coverings acting as light filters for disease control is discussed. 54 refs.  
**ISRAEL**  
Accession no.535447
Item 231  
**Plasticulture**  
No.102, 1994, p.2-6  
English; French  
**LONG-LIFE FILMS FROM BLENDS OF POLYETHYLENES**  
Sanchez S; Prado H L; Ramirez E; Martinez J G  
Centro de Investigacion en Quimica Aplicada  
Greenhouse covering films based on blends of LDPE with linear LDPE were subjected to natural ageing tests in Mexico in order to find a formulation for films with a service life of more than three years at a thickness of 140 microns. The films were stabilised with hindered amines, nickel complexes and combinations thereof. Degradation was followed by assessing the loss of elongation at break.  
MEXICO  
*Accession no.535446*

Item 232  
**Plasticulture**  
No.101, 1994, p.45-9  
English; French  
**ECOLOGICAL GROWING OF LEEKS WITH PLASTICS**  
Benoit F; Ceustermans N  
European Vegetable R & D Centre  
Perforated black and white PE film mulches and PE and PP nets were used in combination for the protection of leeks against thrips. The ecological advantages of this approach in eliminating the use of insecticides and of herbicides for weed control are discussed. 10 refs.  
SODoca; LANKHORST TOUWFABRIEKEN BV  
BELGIUM; EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; NETHERLANDS; WESTERN EUROPE  
*Accession no.521708*

Item 233  
**Plasticulture**  
No.101, 1994, p.33-44  
English; French  
**ROLE OF SUPPORTING STRUCTURE, DUST AND CONDENSATION IN THE LIGHT TRANSMISSION OF GREENHOUSE COVERING FILMS**  
Jaffrin A; Morisot A  
URIH-INRA  
Factors affecting the light transmission of plastics film covered greenhouses are examined. It is shown that improvements in light transmission resulting from the use of less substantial supporting structures can be offset by dust accumulation on the external surface of films and condensation on the internal surface. Results are presented of studies of the effects of dust and condensation on the light transmission of EVA films with and without wetting agents. 7 refs.  
EUROPEAN COMMUNITY; EUROPEAN UNION; FRANCE; WESTERN EUROPE  
*Accession no.521707*

Item 234  
**Plasticulture**  
No.101, 1994, p.13-22  
English; French  
**INFLUENCE OF THE SPECTRAL QUALITIES OF MULCH FILMS ON SOIL TEMPERATURES AND PEPPER PRODUCTION**  
Hatt H A; McMahon M J; Linvill D E; Decoteau D R  
Clemson,University; New Mexico,State University  
Pepper plants were grown under PE film mulches of different colour and spectral characteristics. The effects of light absorption, reflection and transmission of the films on soil temperatures and plant growth and yield were investigated. 11 refs.  
POLYWEST; REDDICK FUMIGANTS INC.  
USA  
*Accession no.521705*

Item 235  
**Antec ’93. Conference Proceedings.**  
**DEVELOPMENT OF BIODEGRADABLE POLYMER FILM FOR CONTROLLED FERTILISER RELEASE**  
Posey T; Hester R D  
Southern Mississippi,University (SPE)  
A two-level factorial experimental design was used to investigate the effectiveness of a biodegradable starch filled LDPE film for the controlled release of a urea fertiliser in rice fields. The results showed that starch content and length of soil exposure were not significant factors in urea release, and that only film thickness was important. Film thicknesses for optimum release rate were calculated. 2 refs.  
USA  
*Accession no.516720*

Item 236  
**European Plastics News**  
21, No.5, May 1994, p.44  
**BLACK MB FOR SILAGE WRAP**  
Cabot Plastics has developed a new black masterbatch for silage stretch-wrap film. Plusblak PE2614 gives protection against heat and light and increased tear resistance without the need for additional additives. The PE grade can be used with cast and blown film on mono and coextrusion lines. It gives good dispersion and dilution quality, providing a finished film with a smooth surface to aid tear resistance. This abstract includes all the information contained in the original article.  
CABOT PLASTICS LTD.  
EUROPEAN COMMUNITY; UK; WESTERN EUROPE  
*Accession no.512727*
**Item 237**  
*Plastics Industry News (Japan)*  
40, No.4, April 1994, p.52  
**FARM USE HDPE FILM**

It is briefly reported that Takilon Co. is marketing a new type of farm-use film based on HDPE. The surface of the sheet is composed of a two step irregular pattern to enable even spreading of water. It is recommended for growing strawberries and flowering plants. The sheeting is to be called Agrimate and is an improved version of the company’s earlier Greensheet.

**TAKILON CO.**  
**JAPAN**  
*Accession no.512674*

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**Item 238**  
*Plastics and Rubber Asia*  
9, No.51, April 1994, p.29  
**BIODEGRADABLE FILM FROM SHANGHAI**

A biodegradable mulching film developed jointly by the Shanghai Chemical Industry Research Institute, the Shanghai Starch Technology Research Institute and the Shanghai Chang Hong Plastics Products Factory has passed technical appraisal. To produce the film starch is first grafted, copolymerised and given hydrophobing treatment with radiation, then blended with PE from which the film is blown. The film features easy processing, low energy consumption and cost. A one year test in the soil has proved that tension strength and elongation at break went down 26-40% and 50-90% respectively. In addition to being applied to agricultural production, the film can be used in packaging and for shopping and industrial bags. This abstract includes all the information contained in the original article.

**SHANGHAI, CHEMICAL INDUSTRY RESEARCH INSTITUTE; SHANGHAI, STARCH TECHNOLOGY RESEARCH INSTITUTE; SHANGHAI CHANG HONG PLASTICS PRODUCTS FACTORY**  
**CHINA**  
*Accession no.511023*

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**Item 239**  
*Plasticulture*  
No.100, 1993/4, p.36-40  
**FLEXIBLE POLYETHYLENE SHEETING IN THE CONSTRUCTION OF AGRICULTURAL RESERVOIRS AND PONDS**

Diesing P  
Werra Plastic GmbH & Co.KG  
The use of Wepelen PE sheeting and film (Werra Plastic) in the lining of agricultural reservoirs and ponds is described. Installation procedures and mechanical properties are presented.

**EUROPEAN COMMUNITY; GERMANY; WESTERN EUROPE**  
*Accession no.511023*

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**Item 240**  
*Journal of Applied Polymer Science*  
51, No.7, 14th Feb.1994, p.1311-7  
**HYDROPHILIC FOAMS CONTAINING CORN PRODUCTS FOR HORTICULTURAL USE**

Cunningham R L; Carr M E; Bagley E B; Gordon S H; Greene R V  
US, Dept of Agriculture, Agricultural Res. Service  
PU foams containing equal amounts of commercial unmodified cornstarch and a polyisocyanate-terminated polyether exhibited properties suitable for horticultural application. Use of cornstarch increased the volume by one-fourth, thus saving 20% in material cost. When cornstarch or cornflour was added to the foam formulation, the foams were more resistant to compressive force. Upon wetting and draining, the foams prepared with no auxiliary blowing agent and containing corn products exhibited higher volumes than did the unfilled foams. Radish seeds planted inside cubes of the foam sprouted after one day. Early growth was similar in control and cornstarch-filled foams. Spectroscopic analyses of the starch-containing foams revealed that 60-79% of the cornstarch was metabolised with 4-5 weeks by a microbial consortium. Control PU foams were not affected by the microorganisms. 13 refs.

**USA**  
*Accession no.503934*

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**Item 241**  
*Plasticculture*  
No.99, 1993, p.33-8  
**FLEXIBLE POLYETHYLENE SHEETING IN THE CONSTRUCTION OF AGRICULTURAL RESERVOIRS AND PONDS**

Diesing P  
Werra Plastic GmbH & Co.KG  
The use of Wepelen PE sheeting and film (Werra Plastic) in the lining of agricultural reservoirs and ponds is described. Installation procedures and mechanical properties are presented.

**EUROPEAN COMMUNITY; GERMANY; WESTERN EUROPE**  
*Accession no.502515*

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**Item 242**  
*High Performance Textiles*  
Jan.1994, p.2  
**DEGRADABLE OLEFIN YARN FOR HORTICULTURE**

A photothermally decomposable yarn has been developed by Lankhorst Touwfabrieken, for use as a twine in accelerated the UV degradation of films, while EBDC alone and in combination with CH appeared to protect the films against degradation. 4 refs.

**USA**  
*Accession no.510094*
agricultural applications, and is covered by European Patent 0 559 252. The basic structure of the twine which is designed for stringing up plants, consists of a polyolefin with incorporated UV stabilisers, whose properties will be sufficient to last a growing season. The yarn is designed to then decompose when it is composted, by means of light initiated degradation and the heat of the compost heap.

LANKHORST TOUWFABRIEKEN BV
EUROPEAN COMMUNITY; NETHERLANDS; WESTERN EUROPE
Accession no.502264

Item 243
Plasticulture
No.98, 1993, p.31-40
English; French
INFLUENCE OF NON-WOVENS ON GROWING WINTER COURGETTES IN SOUTHERN MOROCCO
Faouzi E H; Choukr-Allah R; Hafidi B; Reyd G
Hassan II,Institut Agronomique et Veterinaire; Fiberweb Sodoca

Results are presented of trials undertaken in southern Morocco in the cultivation of winter courgettes under Agryl P.17 non-woven fabric, applied as direct cover or supported on hoops. Such covering gave protection against frost and viruses and produced earlier crops. 11 refs.
EUROPEAN COMMUNITY; FRANCE; MOROCCO; WESTERN EUROPE
Accession no.495696

Item 244
Plasticulture
No.98, 1993, p.11-8
English; French
GROWING COTTON UNDER PLASTICS FILM
Marquez F
DGITFAP

Based on trials undertaken in southern Spain, an examination is made of the advantages and disadvantages of cultivating cotton under perforated linear LDPE films. 7 refs.
EUROPEAN COMMUNITY; SPAIN; WESTERN EUROPE
Accession no.495694

Item 245
Plasticulture
No.97, 1993, p.33-40
English; French
UNHEATED PLASTICS GREENHOUSES FOR NURSERY USE THROUGHOUT THE YEAR
Rosocha C

The climatic control of unheated plastics film covered greenhouses for use throughout the year is discussed. It is shown that considerable improvements can be achieved by increasing the ventilation capacity and by the use of a double film covering, possibly with inflation to produce a thin cushion of air insulation. 1 ref.

AGRIPLAN; FILCLAIR SA;
HANNOVER,UNIVERSITAT; INSTITUT FUER TECHNIK IN GARTENBAU UND LANDWIRTSCHAFT
EUROPEAN COMMUNITY; FRANCE; GERMANY; WESTERN EUROPE
Accession no.489569

Item 246
Plasticulture
No.97, 1993, p.17-22
English; French
CONTROL OF THE WEATHERING OF POLYMERS IN PLASTICULTURE
Lemaire J
Blaise Pascal,Universite; Ecole Nationale Superieure de Chimie de Clermont-Ferrand; Centre National d’Evaluation de Photoprotection

Techniques used to evaluate the weathering characteristics of plastics for agricultural applications are reviewed, and examples are given of research projects in this area undertaken by Centre National d’Evaluation de Photoprotection of France. 2 refs.
CLERMONT-FERRAND,UNIVERSITY
EUROPEAN COMMUNITY; FRANCE; WESTERN EUROPE
Accession no.489567

Item 247
European Polymer Journal
29, No.8, Aug.1993, p.1041-5
AGRICULTURAL POLYMERS WITH HERBICIDE/FERTILISER FUNCTION. III. POLYUREAS AND POLY(SCHIFF BASE)S BASED SYSTEMS
Akelah A; Kenawy E R; Sherrington D C
Tanta,University; Strathclyde,University

Tartrate diethyl esters, glutarate diethyl esters, tartrate dihydrazides and glutarate dihydrazides of the agricultural chemicals dichlorophenoxyacetic acid (2,4-D) and 4-monochloro-2-methylphenoxyacetic acid (MCPA) were prepared. Polymeric herbicides were synthesised by polycondensation of the hydrazides with hexamethylene diisocyanate to form polyureas or terephthaldehyde to form poly(Schiff Base). The effects of chemical structure and temperature on the hydrolytic release of herbicide was investigated. 16 refs.
EGYPT; EUROPEAN COMMUNITY; UK; WESTERN EUROPE
Accession no.486454

Item 248
Chemical Engineering
100, No.6, June 1993, p.48
POLYMERS HELP TAME THE SAHARA
Moore S
Polyacrylic acid sodium salts are being used to make arid desert soil suitable for crop farming on the edge of the Sahara Desert. The polymers are compounded with clay and worked into the soil where results indicate they can cut water requirements by up to 57%. The products can adsorb several thousand times their weight in water, then release it. Further brief details of the project are given.
EGYPT
Accession no.485984

Item 249
MINERAL CATALYSED PHOTODEGRADABLE FILM
Hancock M; Marsh J E; Lee R L
ECC International Ltd. (BPF; PRI)
The use of a very fine china clay, Speswhite, in conjunction with standard UV stabilisers, to give controlled complete breakdown of PE mulching film, leaving a powdered residue of china clay and polymer, is described. The mechanism of degradation is briefly discussed as are the thermal barrier properties of the china clay. 7 refs.
EUROPEAN COMMUNITY; UK; WESTERN EUROPE
Accession no.476534

Item 250
Plasticulture
No.96,1992,p.35-44
English; French
COEXTRUDED FILMS IN SILAGE
Daponte T
Hyplast NV
The influence of thickness, colour, temperature and intrinsic oxygen transmission rate on the oxygen permeability of plastics silage films is discussed, and the advantages of coextruded black/white films are examined in terms of improved barrier properties and reduced waste generation.
BELGIUM; EUROPEAN COMMUNITY; WESTERN EUROPE
Accession no.475033

Item 251
Plasticulture
No.96,1992,p.29-34
English; French
COMPARATIVE AGRONOMICAL EXPERIMENTS ON GREENHOUSE FILMS STABILISED WITH HALS AND NICKEL QUENCHERS
Lagier J; Rooze A K; Moens F
Institut National de la Recherche Agronomique; Exxon Chemical Co.,Polymers Group
Results are presented of trials undertaken at Alenya in France on the cultivation of lettuce and sorghums in tunnel greenhouses covered with EVA films, some of which were stabilised with nickel quenchers and others with hindered amine light stabilisers (HALS). It was shown that HALS stabilised films had improved light transmission, leading to higher crop yields.
BELGIUM; EUROPEAN COMMUNITY; FRANCE; WESTERN EUROPE
Accession no.475032

Item 252
Plastics Technology (Hong Kong)
No.8,1993,p.90
ECOLOGICAL AGRO-FILM
The development of a novel, non-toxic, environmentally friendly, degradable agricultural film made from stalks of wheat, rice, sugar cane and other crops, is reported. The film , used to cover growing crops, was developed at the Beijing Research Institute of Membrane Science & Technology and could be used as a replacement for PE films.
BEIJING,RES.INST.OF MEMBRANE SCI.& TECHNOL. CHINA
Accession no.473231

Item 253
Plastiques Modernes et Elastomeres
44,No.8,Oct.1992,p.103-5
French
AGRICULTURE AND PLASTICS
Desfilhes P
Applications of plastics in agriculture and horticulture are reviewed, and an examination is made of polymers supplied by a number of companies for agricultural use. Developments in the recycling of waste plastics arising from such applications are discussed.
COMITE DES PLASTIQUES EN AGRICULTURE; EXXON CHEMICAL CO.; ENICHEM POLIMERI SPA; ELF ATOCHEM SA; ALPHACAN SA; GE PLASTICS; BASF AG; BAYER AG; BP CHEMICALS LTD.; DOW CHEMICAL CO.; COMMISSION POUR LA REVALORISATION DES PLASTIQUES EN AGRICULTURE EUROPEAN COMMUNITY; FRANCE; GERMANY; ITALY; UK; USA; WESTERN EUROPE
Accession no.473175

Item 254
Plasticulture
No.95,1992/3,p.45-9
English; French
INFLUENCE OF PHOTOSELECTIVE MULCH FILMS ON TOMATOES IN GREENHOUSES

References and Abstracts
Tsekleev G; Boyadjieva N; Solakov Y; Tabakova M
Maritza Institute for Vegetable Crops; Polymerstroy
In English and French. Tests were undertaken in Bulgaria
to assess the influence of photoselective mulching films
on the cultivation of tomatoes in unheated tunnel
greenhouses covered with LDPE films. The mulches
evaluated included transparent, black, white opaque,
orange and mauve LDPE films and a green PVC film.
All the films tested had a positive effect on the yield and
quality of spring grown tomatoes, with the white opaque
PE film giving the best overall results. 7 refs.
BULGARIA; EASTERN EUROPE
Accession no.466586

Item 255
Plasticulture
No.95,1992/3,p.11-20
ECOLOGICAL VEGETABLE GROWING WITH
PLASTICS
Benoit F; Ceustermans N
Belgium, Vegetable Research Station
In English and French. Results are presented of vegetable
growing trials undertaken in Belgium using plastics
cloches, mulch and anti-insect screens. Materials
evaluated included LDPE, EVA and PVAL films and PP
non-woven fabrics. 9 refs.
BELGIUM; EUROPEAN COMMUNITY; WESTERN EUROPE
Accession no.466581

Item 256
Plasticulture
No.94,1992,p.21-7
SIMPLIFIED RAISING OF MAT-TYPE RICE
SEEDLINGS WITH PLASTICS FILM
Rehman A; Ashraf M
Pakistan, National Agricultural Research Centre
In English and French. Details are given of a technique
used in Pakistan for raising rice seedlings, in which PE
film is laid over the seedbeds to prevent the roots from
penetrating deep into the soil and becoming intertwined.
The quality of seedlings raised in this way is found to be
equal to that of plants raised in plastics trays. 7 refs.
PAKISTAN
Accession no.466424

Item 257
European Polymer Journal
28,No.11,Nov.1992,p.1321-4
CONTROLLED RELEASE FROM PVC
MATRICES, EFFECT OF FOUR PHTHALATE
PLASTICISERS ON DIFFUSION OF THF
Shailaja D; Yaseen M
Indian Institute of Chemical Technology
In order to develop a versatile monolithic controlled
release device, a large number of PVC matrices were
prepared containing a dialkyl phthalate at concentrations
ranging from 10 to 30%. To assess the plasticiser
efficiency, the diffusion coefficient of the THF molecule
in PVC matrices was studied by gravimetric desorption
measurements. The uses of these controlled release
devices in agricultural applications is mentioned. 11 refs.
INDIA
Accession no.464048

Item 258
European Polymer Journal
28,No.8,Aug.1992,p.841-62
CONTROLLED RELEASE OF AGROCHEMICAL
MOLECULES CHEMICALLY BOUND TO
POLYMERS
Kenawy E R; Sherrington D C; Akelah A
Strathclyde, University; Tanta, University
This paper reviews current controlled release technology
involving delivery systems in which the agricultural
chemical is chemically bound to a polymer. Polymeric
anti-fouling paints and wood preservatives are also
mentioned. Aspects covered include the economics of this
technology and the environmental advantages. 104 refs.
EGYPT; EUROPEAN COMMUNITY; UK; WESTERN EUROPE
Accession no.462909

Item 259
Advances in Polymer Science
No.104,1992,p.97-133
CHEMISTRY AND PHYSICS OF
AGRICULTURAL HYDROGELS
Kazanskii K S; Dubrovskii S A
Russian Academy of Sciences
A review is presented of methods of superabsorbent gel
synthesis, measurements and treatment of their
properties, as well as their effects in soil and on plant
growth. The thermodynamics of swelling behaviour are
discussed. 139 refs.
RUSSIA
Accession no.460915

Item 260
High Performance Textiles
July 1992,p.7-8
HORTICULTURAL SHEET SUPPLIES
NUTRIENTS
Fisons PLC
A horticultural sheet which supplies nutrients to plants
has been under development by Fisons. The sheet, which
is covered by patent GB 2 245 555, consists of a web of
fibre, fertiliser and a water absorbent polymer, preferably
with ion exchange properties. Details are given of the
types of components suitable for the structure, their ratio
and applications.
EUROPEAN COMMUNITY; UK; WESTERN EUROPE
Accession no.459627
MEASUREMENT OF THE TIGHTNESS OF SILAGE STRETCH WRAPPING
Gaillard F
CEMAGREF

In French and English. Details are given of a method developed by Cemagref for measuring the air permeability of stretch films used for wrapping silage bales. The principle of the test method is based on measurement of the difference between the pressure inside the wrapped bale and the ambient pressure.

EUROPEAN COMMUNITY; FRANCE; WESTERN EUROPE
Accession no.457342

TECHNOLOGY AVAILABLE FOR RECYCLING AGRICULTURAL MULCH FILM
Llop C; Perez A
DOW CHEMICAL IBERICA SA

A programme to recycle LLDPE films used to mulch cotton in Spain was initiated. Aspects studied were the collection system, the recycling technology and the applications of the recycled material. The long strips made transportation difficult. Size reduction and washing were the most critical steps in the recycling process. The film was tough and was highly contaminated by soil that contained iron, a degradant for PE. Details are given of the apparatus and optimum settings. Mixtures of the reclaimed mulch with reclaimed greenhouse films were used to make garbage bags, but mechanical properties indicate adequate quality for other applications. 2 refs. (IUPAC, Macromol. Div., Int. Symp. on Recycling of Polymers. Science & Technology. Marbella, Spain, 18th-20th Sept. 1991).

EUROPEAN COMMUNITY; SPAIN; WESTERN EUROPE
Accession no.4455126

PVC FILM PREVENTS GROWTH OF ALGAE
MITSUBISHI KASEI KOGYO KK

Very brief details are noted of Patent No.JO 3231-848-A: PVC resin film with algae-preventing properties for agricultural use, assigned to Mitsubishi Kasei. The PVC film is heat treated on either one or both sides with a silane compound.

JAPAN
Accession no.445138
GUJARAT, AGRICULTURAL UNIVERSITY

(In English and French). In an attempt to control root-knot nematodes in a tomato nursery in India, the following treatments were carried out in both irrigated and non-irrigated soils, before sowing tomato plants: (A) soil covered with standard transparent LDPE film, 400 gauge; (B) soil covered with UV-treated transparent LDPE film, 1000 gauge; (C) as A, with standard black film; (D) soil treated with phenamiphos (nematicide); (E) control, with no cover or nematicide. The covers were left for two months, in summer, before sowing. The authors concluded that treatments A and B were as good as D in effectively controlling root-knot nematodes. A and B also reduced the weed population by 87.5% and 87.0% respectively. 5 refs.

 Item 267  
 Plasticulture  
 No.91, 1991, p.17-22  
 WAVELENGTH SPECIFIC TRANSMISSION OF POLYETHYLENE FILM GREENHOUSE GLAZING  
 Giacomelli G A; Ting K C; Fang W  
 RUTGERS UNIVERSITY  
 (In English and French). This study evaluated the wavelength dependent transmission of radiation through a PE film greenhouse cover and examined the influence of film weathering on this process. The wavebands studied were 400 to 700nm (photosynthetic spectrum) and 300 to 1100nm. After 48 months, tests on the weathered film were complete and the results were compared with tests on new film, from the same batch of film, which had lasted for four weeks. Weathering reduced the overall transmission for both wavebands studied but reduction in the 400 to 700nm band was greater. Transmission of the 1000 to 1100nm waveband was not affected by weathering. The clearness index, which gives an indication of the sky clearness during each test day, influences the relative transmission for both wavebands. Glazing transmission for specific wavebands can be measured for operational greenhouses using a spectroradiometer. 12 refs.

 Item 268  
 Journal of Thermal Insulation  
 EFFECT OF ENVIRONMENTAL CONTAMINANTS FROM AGRICULTURAL BUILDINGS ON EMITTANCE OF REFLECTIVE SURFACE INSULATIONS  
 Riskowski G L; Christianson L L; Miller R G  
 ILLINOIS, UNIVERSITY; WALTER J., RESEARCH CORP.  
 Three reflective aluminium-faced insulations were exposed to four agricultural building environments for 14 months in both wall and ceiling configurations. The insulations employed were a foil-faced bubble pack, an uncoated foil-faced polyisocyanurate foam and white coated foil-faced PU foam board. Samples of foil-faced bubble pack were also exposed in stud wall cavities for 11 months. Most of the exposed insulations exhibited a significantly higher emittance after 14 months whereas the wall cavity exposed bubble pack did not experience a significant increase in emittance. 9 refs.

 Item 269  
 Macplas  
 15, No.123, Nov. 1990, p.139-40  
 Italian  
 PLANT PROPAGATION IN CELLULAR PLASTICS  
 Pacini L  
 A detailed discussion is presented of horticultural applications of cellular PS, i.e. in the form of seed trays and propagators. The various sizes are considered, e.g. in relation to stacking on pallets for transport. Techniques of use are outlined and potential future developments explored. Waste disposal problems generated in Italy by the consumption of some 1,200 tonnes of cellular PS in this application are combatted by recycling, incineration, or incorporation, after comminution, in the soil or as lighteners in cements and the like.

 CENTRO NAZIONALE APPL. MAT. PLAST. AGRIC. EUROPEAN COMMUNITY; ITALY; WESTERN EUROPE  
 Accession no.427200

 Item 270  
 Modern Plastics International  
 21, No.4, April 1991, p.28/30  
 GLASS IMPROVES HEAT RETENTION IN AGRO-FILMS  
 Mapleton P  
 A masterbatch developed by Mitsubishi Petrochemical for LDPE and EVA agricultural films contains glass filler which is claimed to improve heat retention in greenhouses. Other information is given in the article on light transmission and field tests.

 MITSUBISHI PETROCHEMICAL CO. LTD. JAPAN  
 Accession no. 421192

 Item 271  
 Plasticulture  
 No.87, 1990, p.47-53  
 PHOTODEGRADABLE FILM RESEARCH: FURTHER RESEARCH INTO THE POSSIBLE TOXIC EFFECT OF PHOTODEGRADABILITY INDUCTORS ON POTATOES AND CANNING TOMATOES

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Casalicchio G; Bertoluzza A; Fabbri A
BOLOGNA, UNIVERSITA; ENICHEM AGRICOLTURA SPA
(In French and English). Crops of potatoes (for cooking) and tomatoes (for canning) were grown to investigate possible toxic effects due to nickel used in photodegradation inductors in certain types of plastic film mulches. In this trial, nickel sulphate was added to the soil to simulate continuous mulching for 60, 120 and 180 years. No symptom attributable to nickel toxicity was seen on either crop. In the potato crop, maximum detected quantities of nickel were in the leaves and stalks and minimum values in the tubers. The peel contained 2 to 6 times more than the pulp. In the tomatoes, the maximum amounts were in the fruits, but in neither crop were there any significant differences between the various treatments being compared. The trials indicated that nickel and especially nickel soluble in water, decreases over a period of time during the cultivation cycles of the tested crops. 6 refs.
EUROPEAN COMMUNITY; ITALY; WESTERN EUROPE
Accession no. 418961

Item 272
Macplas International
Aug. 1990, p. 69-75
AGRICULTURAL PLASTICS
Some agricultural applications of plastics for climates ranging from the Mediterranean to the Arctic Circle are reviewed. Topics covered include the production, properties and advantages of various types of plastic films for silo, tunnel and greenhouse covering and mulching and of plastic sheets for greenhouses. Latex spray mulch is also mentioned. Applications of plastics for irrigation systems and thermoformed planting-out pots are also mentioned. Reclaiming plants and processes for greenhouse and mulch film, and for grinding plastic agricultural crates are described.
EASTERN EUROPE; USSR; WESTERN EUROPE; WESTERN EUROPE-GENERAL
Accession no. 417818

Item 273
Journal of Applied Polymer Science
41, No. 9/10, 1990, p. 1961-4
DURABILITY INDEX IN THE WEATHERING OF LDPE FILMS
Gonzalez A; de Saja J A; Requejo A; Barahona F J
REPSOL QUIMICA SA; VALLADOLID, UNIVERSIDAD
Degradation resulting from weathering of LDPE films used in agricultural applications was investigated by means of a series of mechanical and spectroscopic methods. A simple, non-destructive and comparatively sensitive test for measuring the durability of these films, which is based on Vickers microhardness indentations, is presented.
EUROPEAN COMMUNITY; SPAIN; WESTERN EUROPE
Accession no. 413368

Item 274
Plasticulture
No. 86, 1990, p. 37-46
EXPERIMENTAL SOLAR GREENHOUSE
Denis P; Silhol M
FRANCE, COMMISSARIAT A L’ENERGIE ATOMIQUE
(In English and French). Results on the development of a greenhouse heated by solar energy which combines low energy losses and investment are presented. A double inflated roof of EVA film was used. Graphs depict solar energy recovered and accumulated energy over 12 months of monitored weather conditions. Annual energy savings of 58.3% and a repayment time for the installed equipment of 5 to 6 years at this particular location were calculated.
EUROPEAN COMMUNITY; FRANCE; WESTERN EUROPE
Accession no. 407817

Item 275
Plasticuture
No. 86, 1990, p. 33-6
FLUORINATED POLYMERS FOR CLADDING GREENHOUSES
Zanon D
PATI SPA
(In English and French). The manufacture, installation and properties of Pati’s TFE 90 agricultural film, a copolymer of tetrafluoroethylene and ethylene, are described.
EUROPEAN COMMUNITY; ITALY; WESTERN EUROPE
Accession no. 407816

Item 276
Plasticulture
No. 86, 1990, p. 21-8
PHOTODEGRADABLE FILM RESEARCH. INITIAL RESEARCH INTO THE POSSIBLE TOXIC EFFECT OF PHOTODEGRADABILITY INDUCTORS ON SWEETCORN AND MELONS
Casalicchio G; Bertoluzza A; Fabbri A
BOLOGNA, UNIVERSITA; ENICHEM AGRICOLTURA SPA
(In English and French). The toxicological effects of heavy metals, particularly nickel and iron, present in the photodegradants in the film are investigated. Amounts of nickel simulating 60, 120 and 180 years of continuous mulching were tested. It is concluded that there is practically no probability of nickel accumulation in crops mulched with photodegradable plastics. 21 refs.
EUROPEAN COMMUNITY; ITALY; WESTERN EUROPE
Accession no. 407815

Item 277
Plasticulture
No. 86, 1990, p. 6-20
EVALUATION OF THE LIGHT STABILITY OF GREENHOUSE COVER FILMS
Henninger F; Pedrazzetti E
CIBA-GEIGY LTD.

(In English and French). Some results obtained with different weathering techniques and the conclusions derived from each evaluation are presented. LDPE films were stabilised with commercially available additives and their chemical structure is shown. Exposure was conducted in a weather-ometer and the CEMP box. The influence of pesticides on the light stability of films and field results from Florida, Bologna and Sicily are reported. 9 refs.

SWITZERLAND; WESTERN EUROPE
Accession no.407814

Item 278
Polymer Degradation and Stability
29, No.1, 1990, p.65-71
PHOTODEGRADABLE FILMS FOR AGRICULTURE
Gilead D
PLASTOPIL HAZOREA

Applications in agriculture of the Scott-Gilead system of controlled degradation of polymer films are described and discussed. 9 refs.
ISRAEL
Accession no.404307

Item 279
Plasticulture
No.85, 1990, p.17-24
GROWING AUBERGINES ON A FEW ECOLOGICALLY SOUND SUBSTRATES
Benoit F; Ceustermans N
BELGIUM, VEGETABLE RESEARCH STATION

(In English and French). This comprehensive article discusses the search for ecologically sound alternative substrates for soil-less growing techniques. The substrates compared were recycled PUR mats, felted poplar fibreboards and expanded perlite powder. Tables are presented comparing physical characteristics of the substrates, and yields according to substrates and irrigation rates. 21 refs.
BELGIUM; EUROPEAN COMMUNITY; WESTERN EUROPE
Accession no.404302

Item 280
High Performance Plastics
Jan. 1990, p.5-6
MULTILAYER POLYMER ENHANCES THE GREENHOUSE EFFECT

The Moscow-based Research Institute of Construction Physics is reported to have developed a multi-layer polymer containing a substance which is opaque when solid but transparent when liquid, changing from one state to the other as day succeeds night. It is claimed to offer hope to those trying to grow plants in greenhouses where daily extremes of temperature make life difficult; brief details are noted.

USSR; RESEARCH INST. OF CONSTRUCTION PHYSICS
USSR; EASTERN EUROPE
Accession no.394193

Item 281
Rapra Review Report
2, No.2, 1989, p.18/1-87
AGRICULTURAL AND HORTICULTURAL APPLICATIONS OF POLYMERS
Garneau J C
INTERNATIONAL COMMITTEE FOR PLAST. IN AGRICULTURE

A review report is presented on the wide ranging usage of plastics in agriculture. Particular reference is made to the use of plastic materials in water management, crop intensification, animal husbandry and harvesting/crop conservation. Particular types of plastics used are also discussed including films and sheet with different properties, such as barrier or degradable features. A bibliography and index is included.
FRANCE
Accession no.382218

Item 282
Plastics in Horticultural Structures. Shawbury, 1973
Keveren R I
RUBBER AND PLASTICS RESEARCH ASSN. OF GT. BRITAIN

A review of the literature is presented on the use of plastics materials in horticultural structures. An extensive bibliography is provided together with full names and addresses of organisations mentioned in the text.
RUBBER AND PLASTICS RESEARCH ASSN. OF GT. BRITAIN
Accession no.9625
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