



Ginegar Plastic Products Ltd.
Kibbutz Ginegar, 36580, Israel
Tel: 972-4-6544220
Fax: 972-4-6547947
Email: GPP@ginegar.co.il

גניגר מפעלי פלסטיקה בע"מ
קיבוץ גניגור, 36580
טל: 04-6544201/9
פקס: 04-6441849
<http://www.ginegar.co.il>



Introduction To The Revolutionary Plastic Mulches

Mulching is an agricultural cropping technique that involves placing organic or synthetic materials on the soil around plants to provide a more favorable environment for growth and production.

Plastic mulches have been used by commercial growers since the early 1960s, with black and clear plastics being the most popular. Plastic mulches normally are used in conjunction with drip irrigation to maintain optimum soil moisture and for improved stand establishment.

Until 20 years ago the farmer had a choice of black mulch white mulch or transparent mulch and the thicknesses that he was offered was between 60 and 40 microns. Three innovations changed all of that. The first was the advent of low linear density polyethylene (LLDPE). The morphology of the molecular structure is such that it enables us to offer the product with the same strength in much lesser thickness.

The second innovation was the adoption of multilayer (3 layer) extrusion. The multilayered technology provided films in which the top layer was selective layer, bottom layer was weed suppressant and the central layer was a tie layer.

The third innovation was the introduction of wavelength selective mulches into the market. Some of these were designed to attract or repel insects and some to provide weed suppression and soil heating at the same time and others were designed to reflect light back into parts of the plant where the light does not reach otherwise.

Advantages of Plastic Mulch

1. Earlier crops (Precocity).

Plastic mulch raises the soil temperature in the planting bed which promotes faster crop development and earlier yields. Black plastic mulch with perfect contact with soil can result in 2 to 7 days earlier harvest while Al-OR sun selector mulch can result in a 10-14 days earlier harvest.

2. Moisture conservation:

Water loss due to evaporation is reduced under plastic mulch. As a result, more uniform soil moisture is maintained and irrigation frequency may be reduced. Mulching is *not* a substitute for irrigation. One of the biggest mistakes made by growers who use mulches for the first time, in a greenhouse or outdoor in the open field, is that they often do not take into consideration that they will be needing less water. If they keep on following the usual pattern of irrigation and fertigation as if there were no mulch, they will find the plants standing in puddles after one or two irrigations and the plants will be stunted or worse than that.

The readjustment to the new regime is performed best with the aid of tensiometers which measure the negative pressure buildup in the soil as the plants consume more and more of the irrigation soil water. Otherwise an experienced farmer can make an intelligent estimate of the amount of irrigation reduction he needs by trying a new regime and feeling the soil with his fingers.

3. Weed control.

Since black plastic mulch and other densely colored mulches prevent light from reaching the soil, growth of annual and most perennial weeds can be prevented. Weeds generally cannot survive under the mulch. Since there are no weeds in and around the target plant all the nutrients applied by fertigation is available for the cultivated plant. Hence the growth of the plant is better.



Ginegar Plastic Products Ltd.
Kibbutz Ginegar, 36580, Israel
Tel: 972-4-6544220
Fax: 972-4-6547947
Email: GPP@ginegar.co.il

גניגר מפעלי פלסטיקה בע"מ
קיבוץ גניגור, 36580
טל: 04-6544201/9
פקס: 04-6441849
<http://www.ginegar.co.il>



4. Improved quality.

Plastic mulches insulates the plants from moist soil, preventing contact and dramatically reducing fruit rot: a drier microclimate reduces plant sensitivity to disease (downy mildew and botrytis) . e.g strawberry

5. Reduced soil compaction.

Better weed control results in less cultivation. Undisturbed beds also remain more friable with less compaction. Weeds between beds can be controlled with directed herbicides or by mechanical means. (The best idea is to spread the mulch between the beds also even the surface where you are walking so that you have no muddy and compacted soil in the field).

6. Reduction in fertilizer losses.

Flood and furrow irrigation techniques tend to leach nitrogen and other water soluble nutrients below the root zone. Since plastic mulch techniques generally include drip irrigation, nutrient loss is kept to a minimum. Nutrients can be injected into the drip system and accurately delivered to the root zone as needed.

7. Insect control.

In some cases, reflective silver/Black plastic mulches help repel aphids and other insects that damage plants and are vectors of viral diseases. Yellow/Brown mulch can help in reducing the white fly attack during the early stage of planting and until the plant foliage covers the yellow film and prevents the insects from seeing it.



Pic -1 Yellow Mulch in Chilli Crop

8. Better microclimate in the root zone:

The plastic mulch creates a micro greenhouse in the top layer of the soil. This becomes evident if we examine the root zone of the plants under mulch and we find a thick mat of white (healthy roots) as compared to the sparse root we will find in the similar kinds of plants not grown under mulch .



Ginegar Plastic Products Ltd.
Kibbutz Ginegar, 36580, Israel
Tel: 972-4-6544220
Fax: 972-4-6547947
Email: GPP@ginegar.co.il

גניגר מפעלי פלסטיקה בע"מ
קיבוץ גניגור, 36580
טל: 04-6544201/9
פקס: 04-6441849
http://www.ginegar.co.il



It is difficult to imagine any open field crop which would not significantly benefit from the use of mulch.

9. Increased yield:

Production under mulch is higher due the advantages mentioned above.



Pic-2 , Use of Mulch in Strawberry

Types of Plastic Mulch

Most plastic mulches for vegetable cultivation vary in thickness from 15 Microns (1 Microns = 1000th part of a millimeter) to 30 Microns and it may be smooth or embossed. Even at very low thicknesses this plastic is built and stabilized for one season in field.

The pattern on hot **embossed plastics** helps reduce contraction and expansion of the mulch. It is more resistant to wind fatigue and cracking. Embossed mulch also provides a better contact between the soil and plastic hence the transfer of incident solar energy to the soil is better in case of an embossed mulch. Plastic comes in rolls 1000 to 1500 mtrs long (depending on the thickness) and are 3 to 6.8 feet wide.

a. Coloured Mulch

What Does Colored Mulch Do?

A mulch's color affects the temperatures below and above the mulch through the absorption, transmission and reflection of solar energy. This affects the micro environment surrounding the plants. The degree of contact between the mulch and the soil also affects soil warming.



Ginegar Plastic Products Ltd.
Kibbutz Ginegar, 36580, Israel
Tel: 972-4-6544220
Fax: 972-4-6547947
Email: GPP@ginegar.co.il

גניגר מפעלי פלסטיקה בע"מ
קיבוץ גניגור, 36580
טל: 04-6544201/9
פקס: 04-6441849
<http://www.ginegar.co.il>



Plants have been found to be most sensitive to blue, red and near infrared. The reason most leaves appear green is because the plant absorbs a large portion of red & blue radiation and reflects the green. By manipulating these colors (wavelengths) in the mulch we can affect the morphology of the plants.

The colored mulch "tricks" the plant into putting more energy into shoots to outgrow other plants. Some colored mulch even "tricks" the plant into producing more and better tasting fruit. Crops seem to have "preferred colors"; Red colored mulch reflects wavelengths of light that enhance the top growth of tomatoes increasing harvest by 10% to 15% over black. Cucumber with a red mulch had increased yields of 18%. Silver aided peppers with increased yields of 22%. Squashes produced 14% more with blue or red. Pale blue or white has been found to enhance root growth and increased the production of potatoes by 15%. Japanese research on carnations with reflective mulch gave a 33% to 107% increase of flowers cut.

Black Mulch

Black plastic mulch is the most popular color used in commercial vegetable production, especially for weed control. As a blackbody absorber, this plastic absorbs all incident solar radiation, including visible, infrared and ultraviolet light. Much of the thermal energy, however, is lost to the atmosphere through convection and re-radiation.

Transferring of thermal energy to the soil can be optimized by maximizing mulch contact with the soil (moist soil). In such a case soil temperatures under black plastic during the daytime can be as much as 5°F higher at a 2-inch depth and 3°F higher at a 4-inch depth than bare soil at the same depths. This can be used in all the crops in general. However it should not be used in hot (desert) climate during the summer as it can cause the burn damage to the young seedlings with physical contact.

Clear Mulch

Soil temperatures during the daytime under clear plastic can reach 8-14°F higher at the 2-inch depth and 6-14°F higher at the 4-inch depth than bare soil at the same depths due to a greater (85 to 95%) solar radiation transmittance. Clear plastic absorbs very little solar radiation. Water droplets that condense on the underside of clear plastic allow solar light (short-wave radiation) in, but block outgoing, long-wave infrared radiation (heat). This heat normally is lost to the atmosphere from bare soil. Incoming solar radiation, however, makes weeds a major problem under clear plastic unless controlled with a herbicide or fumigant or other means.

Solarization or disinfecting of the soil has been used in some areas of the country to reduce soil borne diseases and some weeds. To achieve sufficiently high temperatures for solarization, the soil must remain covered for several weeks during the hot part of the summer. When performing solarization it is recommended that the soil be at field capacity. This mulch is used in the winters as it warms the soil on the beds to take early crop. It is used for melons, water melons and squash in the winter.



Ginegar Plastic Products Ltd.
Kibbutz Ginegar, 36580, Israel
Tel: 972-4-6544220
Fax: 972-4-6547947
Email: GPP@ginegar.co.il

גניגר מפעלי פלסטיקה בע"מ
קיבוץ גניגור, 36580
טל: 04-6544201/9
פקס: 04-6441849
<http://www.ginegar.co.il>



Pic-3 Use of Clear Mulch in Ground Nut

White and black .

Co-extruded white on black plastic mulch helps cool the soil (white) while controlling weeds (black) . **This is a bi-colour mulch used with the white side of the mulch facing upwards.** Light is reflected back into the atmosphere or the plant canopy from the white side of the plastic mulch, resulting in slightly cooler (-2°F at 1-inch depth) soil temperatures. White plastic mulches can be used to establish crops in the summer, when a reduced soil temperature might be beneficial. The light reflected back into the plant canopy with white mulches also can be helpful for some greenhouse crops that have limited light.

This can be used in all the crops in the summer. In greenhouse 150 microns black and white mulches are used to cover the entire surface to enhance the quantity of PAR light available to plant.

Silver Black

Reflective silver or aluminum mulches also give cooler soil temperatures. They tend to repel aphids, which can serve as vectors for various viral diseases. In addition to this it is recommended for strawberry (a winter crop) because it transmits enough of the incident light to the soil to enhance warming and the same time reflects 20-25% of the light back into the plants.

Red/ Brown (red/slt)

Red plastic mulch has been shown to increase tomato yields and quality in some trials and reduce the severity of early blight in others. It also has been shown to increase yields of honeydews, muskmelons and zucchini. In addition, it has been shown to significantly increase soil temperatures .

Tomatoes that were grown over red plastic had larger shoots and smaller roots than plants grown over other colored plastic such as white or black. Since the plastic keeps the soil moist and protected, a slightly smaller root would not harm the plant. For tomatoes, using the red colored mulch gave a 20%



Ginegar Plastic Products Ltd.
Kibbutz Ginegar, 36580, Israel
Tel: 972-4-6544220
Fax: 972-4-6547947
Email: GPP@ginegar.co.il

גניגר מפעלי פלסטיקה בע"מ
קיבוץ גניגור, 36580
טל: 04-6544201/9
פקס: 04-6441849
<http://www.ginegar.co.il>



increase in the first harvest of tomatoes. This is important to farmers because the first fruit of the season can bring in the most money.

Other colors.

Yellow, orange, blue and gray plastic mulches also have been evaluated. The different radiation patterns that are reflected back into the canopies of various crops from these mulches affect plant growth and development in different ways. Some colors like yellow attract certain insects like green pea aphids and cucumber beetles. Such mulches might be used in a field to grow "catch crops" to pull insects away from other crops. Blue-colored mulches have been shown to increase zucchini and honeydew yields. More research needs to be conducted to determine the effects of these colors on plant growth, yields, earliness and pest resistance.



Pic -3 Mulching in Egg Plant.

Wavelength-selective mulches AI-OR Brown/Green.

These mulches selectively absorb photo-synthetically active radiation (PAR), while transmitting solar infrared radiation. Also called infrared-transmitting (IRT) mulches, they control weeds and exhibit improved soil-warming characteristics, although generally not as well as clear plastic but much more than black mulch. There are two types of selective wavelength weed suppressing mulches (Not black) one has a brown colour called AI OR and the other is green. It is good mulch for no weeds soil warming. Mostly suited for winter crops.

It is obvious that mulching can do wonders in modern agriculture and this is a tool for the 2nd green revolution into India.