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Jawaharlal Nehru
"Step Out From the Old to the New"

Indian Standard
SURFACE COVERED CULTIVATION — PLASTICS MULCHING — CODE OF PRACTICE

ICS 65.040.30
FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Agricultural Produce Processing and Milling Machinery and Surface Covered Cultivation Structures Sectional Committee had been approved by the Food and Agriculture Division Council.

The practice of mulching in agriculture is very old. Crop residue, paper, soil, pebbles and synthetic materials have been used as mulches under diverse agro-climatic conditions. The main objectives of using the practice of mulching have been water conservation, weed control and soil temperature modification. However, pest control and carbon di-oxide (CO$_2$) enrichment have also been observed as benefits of mulching. With the advent of plastics films, it has been possible to achieve the whole range of benefits provided the right kind of material is used correctly. Plastics mulching have become very relevant for sustainable environment-friendly agriculture because it reduces the requirements of fertiliser and agro-chemicals by better utilisation efficiency. The plastics mulching also reduces soil erosion. A need has been felt to include relevant information in this standard to guide prospective users to select appropriate plastics mulch films for the intended applications and use it correctly.

In preparation of this standard, considerable assistance have been derived from Indian Agriculture Research Institute, Pusa, New Delhi.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (revised)'. The number of significant places retained in the rounded off value should be the same that of the specified value in this standard.
Indian Standard
SURFACE COVERED CULTIVATION — PLASTICS MULCHING — CODE OF PRACTICE

1 SCOPE
This standard covers recommendations for the selection of plastics mulch film and the methods of application.

2 TERMINOLOGY
For the purpose of this Indian Standard, following definitions shall apply.

2.1 Mulching
Mulching is the practice of covering the soil around a plant or a row crop plants with a suitable material to modify the soil environment favourably and to reduce evaporation losses and weed population.

2.1.1 Gravel Mulch
Gravel mulches of 5 to 10 mm thickness not only reduce evaporation from soil surface but also improve infiltration of water into soil. Depending upon the colour of the gravel, the soil is warmed or cooled.

2.1.2 Latex, Asphalt, Oil Mulches
These mulches have been found suitable in specific desert situations. This type of mulch also stores the daytime heat and thus keeps soil warm during cold nights.

2.1.3 Live Mulching
It is a process of growing cover crops such as moong and urd to provide the advantage of mulching for the main crop.

2.1.4 Organic Mulches
The organic materials such as crop by-products, farm yard manure (FYM) and by-products of timber industry, when used for mulching, are known as organic mulches. Organic mulches create no post-utilisation disposal problem but their availability cannot be assured.

2.1.5 Plastics Mulch
Plastics materials like polyethylene and polyvinyl chloride films are used as mulch materials. While natural mulches may not be available at all times and places, plastics mulches can be made available in different colours and thickness to obtain the desired effects.

2.1.5.1 Photo-degradable plastics mulch
Those plastics mulching materials, which get disintegrated under sunlight over the designed mulching period.

2.1.5.2 Bio-degradable plastics mulches
Those plastics materials which get disintegrated under natural environmental conditions and get mixed with the soil after the mulching period. These plastics materials may be cellulose based.

2.1.5.3 Nutritional mulches
These plastics mulches which are designed to release plant nutrients slowly into the plant root zone while acting as a normal plastics mulch.

2.1.5.4 Reflective mulching
A plastics mulching material, which acts as reflective surface facing the sky. These mulches have been found to keep the soil cooler than the air and thereby enhance photosynthesis.

2.1.6 Soil Mulch or Dust Mulch
If the surface of the soil is loosened, it acts as mulch for reducing evaporation. This loose surface soil is called soil mulch or dust mulch. Inter cultivation creates soil mulch in a growing crop.

2.1.7 Stubble Mulch
Crop residues like wheat straw, cotton stalk, etc, are left on the soil surface as stubble mulch. The advantages of stubble mulch are protection of soil from erosion and reduction of evaporation losses. When wheat straw or paddy straw is used as the mulching material, it is called straw mulch.

3 SELECTION OF PLASTICS MULCH FILMS

3.1 Colour
Colour of plastic mulch may be black, transparent, white reflective, blue, red or any other. Selection of colour depends upon the specific purpose for mulching. For most mulching applications, that is, moisture conservation and weed control, black film is used. If the objective is to conserve moisture and control weeds without raising soil temperature then the colour of the mulch film should be either milky white or aluminised reflective. For applications where soil temperature needs to be enhanced, that is, either soil solarization or crop cultivation under cold climatic condition, the mulch film should be transparent. Mulch films of red, green, blue and yellow may be used with advantage for specific crops. However, the experience is not adequate to make clear recommendations.

3.2 Width
The film width should be such that the crop agronomic practices could be conveniently followed. The width
of 90 cm and 120 cm are more common. The aim, therefore, should be to make use of available width of mulch film in the most effective manner.

### 3.3 Thickness

Economics suggests that the film thickness should be the minimum possible commensurate with the desired life and strength. Considering only one season use, the film for vegetable crops should last for 3 to 6 months and the film thickness should be not more than 20 microns. For annual crops such as sugarcane, the thickness of the film may be up to 30 micron. For orchards, the film thickness should be considerably more to last for several years. Replacement of film after a period of, say, three years in orchards may be contemplated and accordingly the film thickness should be decided. Recommended thickness of mulch films for different crops are given in Table 1.

#### Table 1 Recommended Thickness of Mulched Film for Different Crops

<table>
<thead>
<tr>
<th>Category</th>
<th>Name of Crops</th>
<th>Mulch Film Thickness, μ</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Seasonal crops</td>
<td>Peanuts, tomato, strawberry, cucurbits</td>
<td>&lt; = 20</td>
</tr>
<tr>
<td></td>
<td>capsicum, lettuce, beans, okra, broccoli, cabbage, cauliflowers</td>
<td></td>
</tr>
<tr>
<td>Annual crops</td>
<td>Sugarcane, papaya, banana, chrysanthemum, gerbera, carnation, brinjal, cotton, maize</td>
<td>20-30</td>
</tr>
<tr>
<td>Perennial crops</td>
<td>Orchard crops, rose</td>
<td>50-100</td>
</tr>
</tbody>
</table>

### 4 LAYING OF MULCH FILMS

Plastics films for mulching should be laid properly in the field, normally, before crop planting/emergence/transplanting. This includes preparation of seed bed, spreading of mulch film, and anchoring of the edges of the film. These operations, if done manually, become very time consuming and costly. However, it is possible to mechanise this activity. Tractor operated mulch laying machines have been developed and are in use in many countries. Availability of such a machines is expected to improve the economics of plastics mulching significantly.

### 5 SOWING/PLANTING/TRANSPLANTING

After laying the plastics mulches, the establishment of crop stand requires the use of devices/tools to make holes in the film at desired intervals and placement of seed/seedlings in the holes. Among various options available for accomplishing this job, hot dibbling is the most appropriate method for making holes in the mulch film.

### 6 FERTILIZER APPLICATIONS

In the full bed mulch system, all fertilizers and soil-applied chemicals should be usually placed in, or on the bed, before the mulch is applied. Following methods may be used to replace the lost fertilizer in the mulched field:

- **a)** Holes are punched through the mulch into which dry fertilizer is placed manually. This method is labour intensive, difficult to calibrate and can result into crop damage if too much fertilizer is placed or if it is placed too close to plants.

- **b)** Liquid fertilizer is placed through the mulch with the mulch transplanting machines. This method requires several trips across a field in order to place enough solution into the beds to satisfy crop needs, especially in the late season. If plants are large, this method can result in damage to plant shoots and roots.

- **c)** The edge of the mulch is mechanically raised and fertilizer is applied along the edge of the bed. This technique can result in damage to mulch and plant roots.

- **d)** Fertilizer is spread in isles between the beds. This method results in poor efficiency in plant utilization of fertilizer and the fertilizer is highly subjected to leaching and run-off.

- **e)** Fertilizer is applied through drip irrigation system. This is the best method of fertilizer application in mulched crops.

- **f)** Use of an injection wheel in mulched fields to apply liquid fertilizer.

### 7 IRRIGATION

The best way of irrigating the mulched crops is through drip method. However, in the event of not using the drip method, other methods of irrigation could be employed. Irrigation through sprinklers is also possible. In case, it is not a continuous mulching, furrow irrigation can be practised. If the mulching is continuous, holes at regular intervals may be punched in the mulch film so that furrow irrigation water could reach the root zone of the crop.

### 8 REMOVAL AND DISPOSAL OF USED MULCH FILMS

Plastics films do not disintegrate quickly in the soil. Therefore, at the end of the season, the mulch film should be removed and disposed off properly so as to avoid any plastics pollution problems. This requires the development of tools and processes for mulch film removal and disposal. If possible, mulch film may be partly recycled and used. A sound strategy will require the liaison with plastics processing industry.
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