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Effect of polythene mulch on corn

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In recent years, with the adoption of intensive agriculture, naturally available inputs are becoming a scarce and synthetic materials such as plastic films are replacing conventional mulching. Use of plastic film mulching, increased the intensity of cobbing and the longest cob of 19.2 cm with maximum number of 501 grain per cob. This resulted in maximum grain yield due to better moisture conservation (Mohapatra *et al.*, 1998). Polythene mulch increases the soil temperature and prevents the loss of nutrients and develop soil micro climate favorable for growth, development and early maturity of the crop.

Polythene mulch is the new technology developed in Japan and mostly used in China. It increases the soil temperature by 2.2 to 3.6^0 C than the normal cultivation (Tang and Xu, 1986). There is early germination under polythene mulch and initial crop growth is also better. It is creating better micro environment and better retention of soil moisture, increase in temperature leading ultimately to higher yield. Better germination and early corn initiation and flowering were also observed under polythene mulch (Mahale *et al*., 2002).

The polythene mulch helps to improve soil structure and soil micro-flora, reduces fertilizer leaching, evaporation and weed problem. Thus, increasing the levels of available nutrients and moisture in the soil. Therefore, polythene mulch has a positive effect on growth, yield and quality of maize (Kulkarni *et al*., 1998).

Transparent polythene mulch absorbs very little solar radiation and transmits 85-95 per cent through it. The under surface of transparent polythene mulch is usually cover with condensed water droplets. This water as well as polythene is transparent to the incoming short wave radiation but it is opaque to outgoing long wave radiation. The heat lost to the atmosphere from a bare soil is retained by transparent polythene mulch and therefore, the soil temperature is $4\text{-}8^0$C higher at 5 cm depth and $3\text{-}5^0$C higher at 10 cm depth, compared to bare soil.

Growth character:

Werminghausen *et al*. (1981) conducted 21 silage maize trials in 1980 at 35-710 m alt. and reported that crop emergence was 4-19 (av. 9.3) days earlier and flag leaf emergence 7-21 (av. 12.5) days earlier than without polythene mulch. Mulching increased the DM content of whole plants, ears and the rest of the plant by 7, 9 and 2 per cent and dry matter yields by 39, 46 and 54 per cent, respectively.

Wells *et al.* (1988) reported after conducting a field experiment at plant science, New Hampshore University, USA on sweet corn that early germination, dry matter production and plant canopy increased were significantly higher under clear polythene mulch as compared to black polythene mulch and bare soil treatments.

Brar and Khera (1988) reported that seedling emergence was earlier by 9 and 7 days and it was also completed earlier by 8 and 3 days and significant increase in plant height under white and black polythene mulch, respectively over control.

Kalaghatagi *et al*. (1990) reported that irrigation at 0.8 IW/CPE ratio with black polythene mulch spread between the rows significantly increased the dry matter at harvest, leaf area at 60 days after sowing.

Nakui *et al*. (1995) conducted the field experiment in Tokachi District on maize and reported that transparent plastic film mulch increased soil temperature by about 4.5 degrees centigrade which advanced crop maturity by 1-2 weeks. Total plant dry matter and ear dry matter were 28-32 % and 52-55 % higher with mulching, respectively.

Kulkarni *et al*. (1998) reported from a field experiment conducted at College of Agricultural Sciences, Dharwad on maize that plant height at harvest, dry matter production and LAI at 60 days improved considerably and significantly under black polythene mulch as compared to

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paddy straw mulch and no mulch treatment.

Pramanik (1999) after conducting a field experiment at Central Agricultural Research Institute, Port Blair on maize reported that plant height and crop growth rate were improved considerably and significantly under paddy straw mulch as compared to saw dust, coir dust, rice husk and no mulch treatments.

Aguyoh *et al*. (1999) reported that sweet corn grown under clear plastic mulch shortened the time to maturity by 10 days on the silt loam site of Midwestern USA.

Bhatt *et al*. (2004) conducted a field experiment at Punjab Agriculture University, Ludhiana on maize and reported that dry matter production with paddy straw mulch was higher by 138% than the dry matter production from bare plots.

Kwabiah (2004) reported from a field experiment conducted at Alantic cool climate crop Research Center for Agriculture and Agri-food Canada on sweet corn that there was increase in soil and air temperature (20^0C) so there was early germination by 3-5 days and correspondingly delayed silking by 8-17 days and maturity by 7-13 day and also higher plant growth under transparent plastic mulch over no mulch treatment.

Miura and Watanabe (2004) conducted a field experiment conducted at Natl. Agricultural Research Centre for Tohoku region, Japan on sweet corn and reported that growth rate and effective weed control were significantly higher under white polythene mulch as compared to red polythene mulch and living leguminous mulch treatments.

Gosavi (2006) after conducting the field trial at Aspee foundation, Thane on sweet corn reported that the significantly greater plant height and numerically increased number of functional leaves per plant and dry matter at 30 and 60 DAS of the sweet corn grown under polythene mulches than no mulch treatment and paddy straw mulch.

Pinjari (2007) conducted the field experiment during 2005-06 and 2006-07 to find out the effect of polythene mulch on sweet corn and reported that plant height, dry matter accumulation per plant and in the different plant parts *i.e*. leaves, stem, grains, cob axis, cob sheath of sweet corn were significantly superior under polythene mulch over no mulch at all the crop growth stages during both the years and in the mean of two years.

Number of leaves (plant $^{-1}$) was significantly superior under polythene mulch over no mulch at 30 and 60 DAS. While, at 90 DAS number of functional leaves under the polythene mulch was at par with no mulch and at harvest. The number of leaves was significantly lower under polythene mulch than no mulch during both the years and in the mean of two years.

Yield attributes:

Wells *et al*. (1988) conducted a field trial at Plant Science New Hampshire University, USA on sweet corn and reported that number of cobs per plant and cob grains were significantly greater in transparent polythene mulch cover than black polythene mulch treatment and without mulch.

Kalaghatagi *et al*. (1990) reported that irrigation at 0.8 IW/CPE ratio with black polythene mulch spread between the rows significantly increased the number of grains/cob, grain weight/cob, 1000 grain weight of maize.

Mohapatra *et al*. (1998) concluded that polythene mulching increased the intensity of cobbing. Mulching with 50 micron LLDPE with irrigation of 50 per cent available soil moisture increased the cobs/plant, cob length, cob diameter, weight/cob, rows of grains/cob, grains/cob and grain yield/ha.

Kulkarni *et al*. (1998) reported from a field experiment on maize conducted at University of Agriculture Science, Dharwad that grain number per cob, grain weight per cop and 1000 grain weight were improved considerably and significantly under black polythene mulch as compared to paddy straw mulch and no mulch treatments.

J-econ (2002) conducted a field experiment at Entomolgical Society of America on sweet corn and reported that cob weight, cob length and number of cob per plant were significantly larger in transparent polythene mulch than from no mulch treatment.

Gosavi (2006) after conducting the field trial at Aspee foundation, Thane on sweet corn reported that the data pertaining to yield attributes indicated that some of them were influenced significantly namely weight of cob, length of cob and kernels per cob by the mulches than no mulch treatments. However, number of rows per cob and number of cobs per plant were not influenced significantly.

Pinjari (2007) conducted the field experiment during 2005-06 and 2006-07 to find out the effect of polythene mulch on sweet corn and revealed that the different yield attributes *viz*. cob length, cob girth, number of grains per cob, number of grain rows, weight of grains per cob and weight per cob during both the years and in the mean of two years were recorded significantly superior under polythene mulch over no mulch.

Yield:

Werminghausen *et al*. (1981) conducted 9 trials where unmulched yield of maize was less than 5 t grains/ ha, polythene mulching increased average yield from 3.82

to 8.37 t /ha

Khatibu *et al.* (1984) studied a wide range of surface treatments was selected to create diverse condition of hydro-thermal regime and soil exposure in Zanzibar, Tanzania on maize and reported that white polythene mulch produced significantly higher yield than other treatments

Wells *et al*. (1988) reported from a field trial conducted at Plant Science, New Hampshire university, USA on sweet corn that significantly higher cob yield was obtained under transparent polythene mulch than black polythene mulch and no mulch treatments.

Brar and Khera (1988) reported that the yield level was significantly higher and reduced maturity period under white polythene than under black polythene mulch, which may be attributed to higher soil temperature maintained under white polythene owing to it's transparency.

Kalaghatagi *et al*. (1990) reported that irrigation at 0.8 IW/CPE ratio with black polythene mulch spread between the rows significantly increased the grain yield and fodder yield.

Chen Xue Jun (1996) reported that maize yield in polythene mulch treatment was 127.5 % than those of direct sown maize.

Mohapatra *et al*. (1998) concluded that polythene mulching increased the intensity of cobbing. Mulching with 50 micron LLDPE with irrigation of 50 per cent available soil moisture increased the grain yield(5.7 t/ha) than unmulched control (4.4 t/ha).

Kulkarni *et al.* (1998) carried out a field trial at University of Agricultural Sciences, Dharwad on maize and reported that cob yield and stover yield were significantly higher under mulch over than paddy straw mulch and no mulch treatment.

Pramanik (1999) conducted a field experiment at Central Agriculture Research Institute, Andaman on maize and reported that mean cob yield and stover yield were significantly higher under paddy straw mulch than saw dust, coirdust, rice husk and control treatment.

Easson and Fearnehough (2000) studied the effect of growing forage maize with or without plastic mulching treatments on the dry matter (DM) yield, cob yield and dry matter content was investigated in Northern Ireland in 1996-97 and reported that plastic mulch, when compared with the unmulched control, increased maize yield from 12.0-14.7 t DM/ha, cob yield from 3.7-6.6 t DM/ha and dry matter content from 230-270 g/kg.

Jaikumaran and Nandini (2001) studied Okra cv. ARKA ANAMIKA mulched with black plastic mulch during 1996-97 and 1997-98. The pooled data indicated that yield of crop increased by 18 per cent with drip irrigation alone and 54 per cent with drip irrigation plastic mulching.

A field experiment was conducted at Banarus Hindu University, Varanasi on maize by Singh *et al*. (2002) and reported that green cob yield, stover yield and benefit cost ratio were significantly higher under stover mulch as compared to the soil mulch and control treatments.

J- econ (2002) conducted a field experiment at Entomological Society of America on sweet corn and reported that cob yield of sweet corn was 1.5 to 2 times grater in transparent polythene mulch plots than from fallow plots.

Sannigrahi and Borah (2002) conducted a field experiment in Assam to evaluate effectiveness of different organic mulches along with black polythene on tomato and okra production under rainfed conditions. The maximum okra yield was recorded with black polythene mulch (121.2 q per ha) followed by water hyacinth (107.1 q per ha) and poultry waste (101.3 q per ha). Black polythene increased okra yield by 88 per cent over control. Also black polythene mulch was the most effective treatment for weed control (83.5 per cent).

Summers and Stapleton (2002) reported that sweet corn yields of marketable ears was 1.5-2.0 times greater in plastic reflective mulch plots than from fallow plots. This was due to the larger ears (individual ear weight and length) rather than an increase in the number of ears.

Bhatt *et al*. (2004) reported from a field trial conducted at Punjab Agriculture University, Ludhiana on corn that straw mulch increased the cob yield by 60.5% as compared to unmulched treatment.

Kwabiah (2004) after conducting a field experiment at Atlantic Cool Climate Crop Research Centre, Agriculture and Agri-food Canada on sweet corn reported that the plastic mulch increased the total biomass yield and cob yield by 8-17% and 3-6% over no mulch, respectively.

Gosavi (2006) after conducting the field trial at Aspee foundation, Thane on sweet corn reported that significantly highest green cob and stover yield (246.69 and303.61 q/ha, respectively) were recorded under polythene mulch than control (194.38 and 235.11 q/ha, respectively).

Pinjari (2007) conducted the field experiment during 2005-06 and 2006-07 to find out the effect of polythene mulch on sweet corn and revealed that number of cobs per plant were significantly higher under polythene mulch during 2006-07 and in the mean of two years and during 2005-06 the differences was not significant.

Number of cobs ha^{-1}, cob yield, straw yield, biological yield (ha^{-1}) were significantly superior under polythene mulch over no mulch during both the years and in the

mean of two years.

Uptake of nutrients:

Singh *et al*. (2002) conducted a field experiment at Banaras Hindu University, Varanasi on maize and reported that total nutrient uptake of nitrogen, phosphorus, potassium was significantly higher under stover mulch than soil mulch and no mulch treatment.

Singh *et al*. (2004) conducted the field experiment to study the effect of different type of mulches [Polythene sheet (M_2) paddy straw (M_1) and unmulched (M_0)] without and with different levels of irrigation[1.2 (I_3), 0.9 (I_2) and 0.6 (I_1) IW/CPE ratio] on content of phosphorus in winter maize and observed that the effect of different mulches and irrigation levels on phosphorus content were in order : $M_2 > M_1 > M_0$ and $I_3 > I_2 > I_1$, respectively.

Zagade (2004) after conducting a field trial at Dapoli on groundnut reported that total nitrogen, phosphorus and potassium were significantly higher under polythene mulch than no mulch treatment.

Kudtarkar (2005) after conducting a field trial at Thane on groundnut reported that total nitrogen, phosphorus and potassium was significantly higher under polythene mulch than no mulch treatment.

Gosavi (2006) after conducting a field trial at ASPEE foundation farm, Thane on sweet corn reported that significantly higher uptake of nitrogen, phosphorus and potassium by the different parts of sweet corn under transparent polythene mulch than control.

Pinjari (2007) conducted the field experiment during 2005-06 and 2006-07 to find out the effect of polythene mulch on sweet corn and reported that nitrogen content and nitrogen, phosphorus and potassium uptake in the leaves, stem, cob sheath, cob axis, kernels and total uptake of nitrogen by the crop (kgha^{-1}) were significantly higher under polythene mulch than no mulch during both the years and in the mean of two years.

Quality characters:

Nakui *et al*. (1995) conducted the field experiment in Tokachi District on forage maize and revealed that total digestible nutrient yield was increased by 2.5-4.0 t/ha by transparent plastic mulch.

Easson and Fearnehough (2000) studied the effect of growing forage maize with or without plastic mulching treatments on the starch content in Northern Ireland in 1996-97 and reported that plastic mulch, when compared with the unmulched control, increased starch content from 198-272 g/kg.

Gosavi (2006) after conducting the field trial at Aspee foundation, Thane on sweet corn reported that significantly highest sugar content in sweet corn was under polythene mulch than no mulch and paddy straw treatments. However, the protein content was not influenced significantly due to mulches. The highest sugar content of 12.26 per cent was recorded with the transparent polythene mulch, which was significantly superior over the remaining treatments.

Pinjari (2007) conducted the field experiment during 2005-06 and 2006-07 to find out the effect of polythene mulch on sweet corn and revealed that the sugar content, protein content and fiber content were significantly superior under polythene mulch than no mulch during both years and in the mean of two years.

Economic:

Gosavi (2006) after conducting the field trial at Aspee foundation, Thane on sweet corn observed that the gross return, net profit and B:C ratio were higher under polythene mulch.

Pinjari (2007) conducted the field experiment during 2005-06 and 2006-07 to find out the effect of polythene mulch on sweet corn and reported that the cost of cultivation, gross returns, net returns were higher under polythene mulch and lowest with control during both the years. However, the B : C ratio under polythene mulch was at par with control.

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