

Original Research Article

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Effect of Different Types of Mulching Materials on Growth and Yield of Chilli (*Capsicum annum L. Cv. Arka Harita*)

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ABSTRACT

An on-farm trial was conducted on various farmers field in different villages of Araria district during financial year 2016-17. This trial was conducted to overcome weed infestation during cultivation of chilli in farmers field. It leads to reduction in yield; quality of produce is inferior as compared to better quality produce, increased the cost of cultivation due to manual hand weeding by laborers and reduced the benefit cost ratio. The trial was conducted in randomized block design with three treatments and ten replications. The different treatments are Technology option -1 is farmers practice, Technology option-2 is use of paddy straw as mulch and Technology option-3 is use of bicolor silver/black plastic 25 micron thickness as mulch material. We got the following results as maximum plant height recorded was 78.10cm in case of use of bicolor plastic mulch as compared to 72.90 cm in case of paddy straw as mulch material and 66.10 cm in case of control. The Highest average number of fruits per plant was 175.40 in case of bicolor plastic mulch as compared to 163 fruits per plant in case of paddy straw mulch and 150.40 in case of control. The maximum average weight of fruit was 4.53gm, fruit yield per plant was 743.84 gm and yield 89.66 quintal per hectare is recorded in case of bicolor plastic mulch as compared to 4.42gm per fruit, 662.57 gm/plant and 84.24 quintal per hectare was found in case of paddy straw mulch and 3.61gm per fruit, 579.14 gm per plant and 75.18 quintal per hectare was recorded in case of control.

Keywords

Chilli, Paddy straw mulching, Bicolour plastic (black/silver) mulching, Number of fruits, Yield, quality

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Introduction

Chilli (*Capsicum Annum L.*) is important spice crop grown in all the tropical and subtropical regions of the world. It belongs to family Solanaceae. It is part of human diet since about 7500 BC. It is one of the oldest cultivated crops in the Americas. The origins of cultivating chilli peppers are noticed to north eastern Mexico some 6000 years ago.

It has good nutritional value. Red chilli have rich amount of vitamin C and pro vitamin A. But yellow and green chilies have lesser amount of these substances as compared to matured red chilies. It also have different types of vitamin B especially vitamin B6. They are good supplement of magnesium, iron and potassium also. The dehydrated green chilies are rich source of vitamin C.

It has medicinal value also. It is used as a tonic and a carminative action. The oleoresin in capsicum is used in pain relief balms and vapo rubs. It is effective in treatment for sensory nerve fiber disorders, including pain associated with arthritis, psoriasis and diabetic neuropathy. The pungency in chilli is due to alkaloid present in pericarp and placenta of fruits is capsaicin.

Chilli is cultivating in an area of 1832 thousand hectares in the world with production of 2959 thousand tons. The leading growing countries are India, China, Indonesia, Korea, Pakistan, Turkey and Sri Lanka in Asia. Nigeria, Ghana, Tunisia and Egypt in Africa. Mexico, United states of America in North central America. Yugoslavia, Spain, Romania, Bulgaria, Italy and Hungary in Europe and Argentina and Peru in South America. India is leading producer of chilli in Asia followed by China and Pakistan (Source: FAO).

The leading chilli growing states of India are Andhra Pradesh (26%), Maharashtra (15%), Karnataka (11%), Orissa (11%), Madhya Pradesh (7%) and 22% in other states. Andhra Pradesh tops among list of dry chilli production followed by Tamilnadu, Maharashtra, Orissa and Karnataka. In India production is dominated by Andhra Pradesh (57%), Karnataka (12%), Orissa (5%), West Bengal (5%), Maharashtra (4%), Madhya Pradesh (3%) and other states about 14% during 2006-07 (Source, Spice board, India).

Chilli is heavy feeder of manure and long duration crop. It requires balanced dose of fertilizer along with proper intercultural operations, moisture level for better yield and quality of produce (Prasad *et al.*, 2009). The crop of chilli is indeterminate in nature. The vegetative and reproductive phases of crop overlap to each other and require nutrition and irrigation up to fruit ripening and maturity.

The reason for water stress is difficult to explain (Begg and Turner, 1976). At the time of flower initiation, during flowering period and up to some extent during fruit development most of the determinate crops are highly sensitive to water stress (Hegde, 1989). The chilli seedlings are sensitive to excess and deficit water but younger is more sensitive as compared to older one (Ayoub, 1986).

Mulch is a material that spread on the surface of soil for conserving moisture, reducing weed infestation on the surface of soil and near vegetation. It also reduces pest and disease incidence in crops. There are two types of mulch materials that are used (a) organic mulch (b) inorganic mulch. In case of organic mulch we are using straw of different crops, dry leaves, grass clipping etc as mulch material. In case of inorganic mulch we are using different types of poly ethylene film as mulch material. In perennial crops generally mulches like polyethylene film, plastic mulch, synthetic mulch etc is used (Memon *et al.*, 2017).

The increase in yield of brinjal with the use of transparent foil, poly ethylene film and poly propylene by 28.3 %, 15.9 % and 11.6 % respectively as compared to conventional method of cultivation (Sowinska *et al.*, 2016). The mulching showed better result on crop growth, yield and different cropping species (Ashworth and Harrison, 1983). The quality and yield attributes of different vegetable crop can be improved by application of plastic mulch (Raina *et al.*, 1999; Bharadwaj, 2013).

Soil properties of the Araria district

There are two broad soil groups are available in the district. Alluvium non-calcareous non-saline groups of soil found in most part of the district. The texture of the soil is light to medium and nature is slightly acidic to

neutral. Trai soils found in north east part of the district. Its texture is light to heavy and poorly drained soil.

The soil of entire Araria district is suitable for all agricultural activities. The major crops grown in the district is paddy, maize, pulses and different types of vegetables. Some local fruits also grown in the district due to its suitability to soil and agro climatic conditions.

There is no horizontal differentiation found in the layered sediments. In north east corner of the district tarai soils are found in small patch. Its composition is highly disturbed recent alluvium. It is ill drained and light to heavy in texture.

The soil properties of Araria district varies in following range as pH from 5.8 to 7.4, EC from 0.2 to 1.35 dS/m, organic carbon from 0.2 to 0.86%, available nitrogen from 110-550 kg/ha, available P₂O₅ from 20-55 kg/ha and available K₂O 78-350 kg/ha.

The initial soil properties of farmers plots was found as average pH value of soil is 6.8, average electrical conductivity of soil is 0.75 dS/m, organic carbon is 0.65%, available nitrogen was 375 kg per hectare, available P₂O₅ was 35 kg per hectare and available K₂O was 180 kg per hectare.

The post harvest soil properties of farmers' plots are varies according to different treatments. The nutrient status of soil in case of paddy mulch application is improved as compared to other treatment details as mentioned in table no-1.

The table no-1 shows that effect of mulching increases organic carbon, available nitrogen and available potash significantly as compared to farmers practice and other soil parameters are at par.

Materials and Methods

The location of Araria district is in north eastern corner of Bihar state with its international boundary in the north is Nepal. Adjoining districts are Supaul in the west, Purnea in the south, Madhepura in the southwest and Kisanganj in the east. The district is situated at latitudes 25° 56' 30'' to 26° 35' 15'' north and longitude 87° 02' 30'' to 87° 42' 45'' east. The district has a geographical area of 2830 square meter.

An on farm trial was conducted on different farmers' field of various villages of the district in Randomized block design. The experiments was conducted during financial year 2016-17 with the chilli variety Arka Hrita. The trial was conducted on ten farmers' field with three replication.

Technology option -1 is farmers practice (Manual hand weeding)

Technology option -2 is mulching with paddy straw (6cm thickness)

Technology option -3 is Bicolour (Silver/Black) plastic mulch with 25 micron thickness

The paddy straw mulch spread on raised bed after transplanting of seedling at a distance of 50 *50 cm. The black plastic mulch was fixed tightly on the raised bed with both ends and sides are buried properly in the soil. After that holes are made at 50 *55 cm and then transplanting of seedlings was done.

In case of control after transplanting of seedlings hand weeding by labourers to control weed infestation. Observation of different parameters like average number of fruits per plant, yield quintal per hectare and economic components was studied.

Results and Discussion

Effect of mulch material on plant growth

As per trial findings maximum height of the plant is 78.10 cm in case of bicolour (black/silver) plastic mulch as compared to paddy straw mulch and control as per table no 2.

Similar result was found in case of Maida *et al.*, (2019) the maximum height was reported in case of silver plastic mulch. The higher growth of plant is due to enhanced soil temperature, reflected sunlight, lesser evapo transpiration and maintained soil moisture due to use of plastic mulch. The improvement in microclimatic condition due to use of mulch leads to higher plant height and higher number of primary and secondary branches. Same results was recorded in chilli by Ashrafuzzaman *et al.*, (2011), in okra by Gordon *et al.*, (2010) and in tomato by Christopher *et al.*, (1996). As per findings of Shinde *et al.*, (1999) the maximum plant height was recorded in case of use of plastic mulch as compared to other mulch material.

The use of plastic mulch leads to increased moisture retention capacity of soil due to lesser evaporation. As per findings of Wang *et al.*, (1998) the soil moisture content in chilli plot is more as compared to control in use of plastic mulch. As per findings of Prajapati *et al.*, (2017) the plant height of chilli plants are increased due to optimum availability of soil moisture and regulated optimum soil temperature.

Similar findings were recorded by Ashrafuzzaman *et al.*, (2011) and Lourduraj *et al.*, (1996) in case of chilli plant. Due to favorable weather condition provided by use of mulch material leads to increased number of branches per plant as per findings of Shrivastava *et al.*, (1994) in tomato plant.

Various factors like moisture conservation, maintainance of soil temperature are influenced by use of mulch material through suppressing growth of weeds. Similar results was found in dry chilli by Ramakrishna (2002), in green chilli by Ayodele *et al.*, (2015), Tumbare and Nikam (2004), Gulshan *et al.*, (2007), Prabhakar *et al.*, (2010) and Pandey *et al.*, (2013) and in case of tomato by Ranjan *et al.*, (2014).

Number of fruits per plant

The maximum average number of fruit per plant was recorded in case of plastic mulch is 175.40 as compared to paddy straw mulch (163.00) and 150.40 in case of farmers practice (control).

Similar findings were recorded in chilli as per Prajapati *et al.*, (2017) and Singh *et al.*, (2002) in tomato. The increase in number of fruit per plant was associated with improved microclimate above and below the soil surface as well as improved moisture conservation as compared to farmers' practices (control). The maximum number of fruit per plant was also reported by Singh *et al.*, (2017) in case of use of plastic mulch as compared to control in tomato. The similar findings were recorded by Hedau N., (1998) and Rahman *et al.*, (2016) in tomato in case of use of plastic mulch as compared to control. As per findings of Kumar et al (2019) the maximum average number of fruits per plant was recorded as compared to control in brinjal.

The maximum number of fruits per plant was recorded in black plastic mulch (472 per plant) as compared to control (335 per plant) as per Ashrafuzzaman *et al.*, (2011). As per findings of Ravinder *et al.*, (1997) the number of fruits per plant increased and decreased the fruit abortion percentage as compared to control in chilli plot.

Table.1 Effect of mulching on post harvest soil properties of experimental plots

Treatments	pH	EC(dS/m)	Organic carbon (%)	Available nutrients (kg/ha)		
				N	P2O5	K2O
Farmers practice	6.80	0.748	0.647	372	36	182
Use of paddy straw as mulch material (6cm thickness)	6.78	0.742	0.654	380	33.8	186
Use of bicolour (Silver/black) plastic as mulch (25 micron thickness)	6.81	0.745	0.649	376	35	181
S.Em.+	.02	0.002	0.002	2.21	0.76	2.32
C.D.@5%	NS	NS	0.006	6.62	NS	6.95

Table.2 Effect of mulching on different quantitative and qualitative parameters in chilli Cv. Arka Harita

Treatments	Plant height cm	Number of fruits per plant	Average weight of fruit in gram	Yield per plant in gram	Yield quintal per hectare
Farmers practice	66.10	150.40	3.61	579.14	75.18
Use of paddy straw as mulch material (6cm thickness)	72.90	163.00	4.42	662.57	84.24
Use of bicolour (Silver/black) plastic as mulch (25 micron thickness)	78.10	175.40	4.53	743.84	89.66
S.Em.+	0.428	0.627	0.007	0.767	0.41
C.D.@5%	1.273	1.865	0.022	2.279	1.219

Yield parameters

Average weight of fruit

The highest fruit weight is 4.53 gm is recorded in bicolor plastic mulch as compared to farmers practice (control) is 3.61gm. The similar result was also recorded in findings of Maida *et al.*, 2019.

Fruit yield per plant

The maximum average fruit yield per plant is recorded in bicolor plastic mulch is 743.84 gm per plant as compared to 662.57 gm per plant in case of paddy straw mulch and 579.14 gm per plant in case of farmers

practice (control). The average yield of plot is 89.66 quintal per hectare in case of bicolor plastic mulch as compared to 84.24 quintal per hectare in case of paddy straw mulch and 75.18 quintal per hectare in case of farmers practice (control).

The similar findings were also recorded by Maida *et al.*, (2019) and Ashrafuzzaman *et al.*, (2011) in case of chilli cultivation. The highest fruit yield of mulched plot was associated with weed control. Conservation of moisture above and beneath the soil surface, decrease in pest and disease incidence improved the plant growth and yield as compared to unmulched plot. As per findings of Kumar *et al.*, (2016) the highest yield of

green chilli was 20.20 tones per hectare with 38% increase in yield as compared to unmulched treatment. Similar findings was also observed by Singh R., (2005), Mukherjee *et al.*, (2010), Singh and Kamal (2012), Ogundare *et al.*, (2015) and Hedau N., (1998) in case of fruit yield in black and double shaded mulch.

As per findings of Ashrafuzzaman. M. *et al.*, fruit yield of chili per plant and per hectare yield is increased due to effect of different plastic mulch as compared to control. The increase in yield in mulched plot due to increase in number of fruit per plant. The similar findings were recorded by Siborlabane (2000) in case of tomato cultivation.

In conclusion as per findings of on-farm trial conducted that bicolour plastic mulch gives best result in case of number of fruits per plant, weight of fruit per plant, yield, reduction in weed infestation etc. as compared to other treatments. Although soil fertility status improved in application of paddy straw as mulch. The organic carbon percentage, available nitrogen, available P₂O₅ and available K₂O increased in soil as compared to other treatments.

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