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EFFECT OF CAPSICUM VARIETIES AND MULCHING ON MAJOR ARTHROPOD PESTS

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ABSTRACT

An experiment was conducted in the experimental field of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh during the period from October, 2019 to February, 2020 to analyse the effect of different mulching materials and varieties against major insect pest and growth performance of capsicum (*capsicum annum* L). The experiment was laid out in Randomized Complete Block Design (2 factor) replicated with three times. For this study, factor A-M_0= No Mulching; M_1= Black polythene Mulching; M_2= Paddy straw; M_3= White polythene Mulching and factor B- V_1= California wonder; V_2= Omax hybrid; V_3= BARI Misti Morich-1; V_4= BARI Misti Morich-2. Results revealed that effect of different mulching materials and varieties against major insect pest and growth performance of capsicum that significantly effect on most of the yield and yield contributing parameters studied in this experiment. Similarly, most of the traits were also affected significantly due to the combination effect. In case of varietal performance, California wonder (V_1) showed the best results in terms of the number of whitefly, number of thrips, number of fruit borer, number of mites, number of aphid, number of leaf, length of leaf, fruit length, fruit breadth, number of fruit, number of infested fruit and total yield. In case of mulching treatments, M_1 (Black polythene Mulching) showed outstanding performance for percent reducing the number of insect pests and getting the better growth and higher yield compared to those of other treatments. Again in case of combinations of varieties and different treatments, the number of infestation was reduced in V_1M_1 and V_1M_1 showed best results in terms of percentage of infested fruit, fruit infestation at weight basis, fruit length, fruit girth, number of fruit Plant^{-1} and total yield. There was negative relationship present in number of insect and percentage of fruit infestation in weight basis with the yield of capsicum, i.e. when the number of insect and percentage of fruit infestation in weight basis was increased the yield of capsicum was decreased.

Key words: Capsicum, mulching, arthropod pests

Introduction

Capsicum (*Capsicum annuum* L.), commonly known as sweet pepper, belongs to family Solanaceae, and an important spice as well as vegetable crop, where both ripe and unripe fruits are used for culinary, salad and processing purposes. As a culinary commodity, *C. annuum* is known, in dried form, as both chilli pepper and paprika (Basu and De, 2003), and fruits are used in salads, are stuffed or baked, added to soups and stews, dried and used as culinary seasoning, or pickled, while leaves make a good spinach dish (FAO EcoCrop, 2014). The commercial use of the species in skin cosmetic products was recently reviewed in a toxicological risk assessment and found to be safe to humans within the ingredient formulae (Anon, 2007). Nutritionally, it is rich in vitamins particularly, vitamins A and C. Hundred gram of edible portion of capsicum provides 24 k cal of energy, 1.3 g of protein, 4.3 g of carbohydrate and 0.3 g of fat (Kaur and Singh, 2013). The insect pests cause significant damage to the chilli crop. There are 39 genera and 51 species of insects and mites attacking chilli in the field, and in the storage which includes thrips, aphids, whiteflies, fruit borers, cutworms, plant bug, mites and other minor pests (Sorensen, 2005). Aphids, thrips, and jassids are the major insect pest of chilli (Jadhav *et al*., 2014). Among thrips, *Scirtothrips dorsalis* (Thripidae: Thysanoptera) is one of the most destructive pest of chilli and under severe infestation 30 to 50 percent crop may be lost (Bhede *et al*., 2008). During field survey in some intensive capsicum growing areas; Rajbari, Manikganj, Bogura, Sylhet and Kishoreganj districts; we found that farmers were practicing different types of mulching methods such as white polythene, black polythene, straw, water hyacinth etc. for controlling insect pests of capsicum. Among them black polythene is seen to be used by a greater

number of farmers. We observed in different locations that black polythene mulching showed best yield, less pest infestation and helping to increase soil temperature as well as conserved the soil moisture by preventing the evaporation of water from soil surface. After field observation, I conducted field research at Sher-e-Bangla Agricultural University considering following objectives: i) To find out the most effective mulching method and control options in reducing pest in capsicum, ii) To compare the yield performance of capsicum between mulching and non-mulching method as well as iii) To find out the most effective variety and mulching materials in controlling insect pests of capsicum.

Materials and Methods

The present study regarding effect of different mulching materials and varieties against major insect pest and growth performance of capsicum has been conducted in the experimental fields of Sher-e-Bangla Agricultural University, Dhaka. The location of the site is 23˚74/N latitude and 90˚35/E longitude with an elevation of 8.2 meter from sea level. The mean highest and mean lowest temperatures in the 6 months are 31.6°C and 18.17°C respectively. During November to February, the temperature was less than the other months of the year and starts increasing after mid- March. The soil of the experimental field belongs to the General soil type, Shallow Red Brown Terrace Soils under Tejgaon soil series. Ranges of Soil PH from 5.4-5.6. The land was situated above the flood level and during the experimental period there was available sufficient sunshine. The soil was well prepared and good tilth was ensured for commercial crop production. The target land was divided into 16 equal plots (1.2 m×1.5m) with plot to plot distance of 0.50 m and block to block distance is 0.75 m. The land of the experimental field was ploughed with a power tiller. Later on the land was ploughed three times followed by laddering to obtain desirable tilth.

Manure and fertilizer : Recommended fertilizers were applied at the rate of 60 kg urea, 70 kg triple super phosphate (TSP), 60 kg muriate of potash (MP), 25 kg Gypsum and 1.25 kg Zinc oxide per hectare were used as source of nitrogen, phosphorus, potassium, Sulphur and zinc, respectively. Moreover, well-decomposed cow dung (CD) was also applied at the rate of 20 ton/ha to the field at the time of land preparation (Miah *et al.* 2005).

Design of experiment and layout: The experiment was laid out in a Randomized Complete Block Design (RCBD) two factors with three replications. The size of the unit plot was 1.2 m×1.5 m. The block to block and plot-to-plot distance was .75m and 0.50m, respectively.

Collection of seed, seedling raising: The seeds of selected capsicum varieties i.e. California wonder, Omax hybrid, BARI Misti Morich-1 and BARI Misti Morich-2 were collected from Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur and Siddik Bazar, Gulistan, Dhaka. Seeds were then sown in seedbed and 25 days old healthy transferred seedlings were transplanted in the main field. Each plot contains 12 seedlings of capsicum with 2 rows followed by 50cm x 50cm (row to row and plant to plant distance, respectively).

Cultural practices: After transplanting, a light irrigation was given. Subsequent irrigation was applied in all the plots as and when needed. Various intercultural operations like gap filling, weeding, earthen up, drainage, sticking, netting, fencing, binding etc. was done as and when necessary to cultivate capsicum.

Treatments: The experiment was evaluated to determine the damage assessment and management of insect and other arthropod pests of capsicum particularly aphid, thrips, cutworm, pod borer and mite. The treatments were used in this study are herein: factor A- V_1= California wonder; V_2= Omax hybrid; V_3= BARI Misti Morich-1; V_4= BARI Misti Morich-2 and factor B-M_0= No Mulching; M_1= Black polythene Mulching; M_2= Paddy straw; M_3= White polythene Mulching.

Data collection and analysis: The data related to arthropod pests, their infestation, leaf growth yield attributes were analyzed by 2 factor randomized complete block design through Statistix 10.0 software and LSD range tests was used to determine the damage assessment and management of insect and other arthropod pests of capsicum.

Results and Discussion

Effect on arthropod pest in capsicum plant: White fly, thrips, fruit borer, mite and aphids are mostly common arthropods/insect pest of capsicum. The significant variation was observed on different varieties of capsicum with applying different mulching methods at the experiment field (Table 1). V_1 (comprised with California wonder) showed the best performance in case of number of whitefly, number of thrips, number of fruit borer, number of mites and number of aphids than the others. M_1 (Black polythene Mulching) showed outstanding performance for percent reducing the number of insect pests of capsicum grown in the experimental field in the Sher-e-Bangla Agricultural University campus. Different combination of varieties and treatments revealed that, V1M1 (comprised with California wonderhot pepper + Black polythene mulching) showed the best performance in terms of on number of whitefly, number of thrips, number of fruit borer, number of mites and number of aphids than the others (Table 2).

Table 1. Effect of different varieties and mulching on arthropod pest in capsicum plant

Treatments	Number of whitefly per 5 tagged plants	Number of thrips per 5 tagged plants	Number of fruit borer per 5 tagged plants	Number of mites per 5 tagged plants	Number of aphids per 5 tagged plants
Variety					
V_1	1.75 d	1.57 d	3.20 d	2.94 d	2.35 d
V_2	3.83 a	2.78 a	3.86 a	8.31 a	3.48 a
V_3	3.15 b	2.28 b	3.72 b	7.36 b	2.97 b
V_4	2.48 c	1.81 c	3.58 c	5.19 c	2.64 c
$LSD_{(0.05)}$	0.30	0.10	0.46	0.46	0.16
CV (%)	3.67	3.67	6.85	6.28	3.71
Mulching					
M_0	3.82 a	3.36 a	3.99 a	7.94 a	4.16 a
M_1	1.12 d	1.06 d	1.49 c	5.25 c	1.03 d
M_2	3.26 b	2.17 b	3.63 ab	4.65 d	3.46 b
M_3	2.37 c	1.86 c	3.54 b	5.96 b	2.79 c
$LSD_{(0.05)}$	0.37	0.13	0.41	0.61	0.17
CV (%)	5.71	3.67	6.85	6.28	3.71

Table 2. Combined effect of different varieties and mulching on arthropod pest in capsicum plant

Treatments	Number of whitefly per 5 tagged plants	Number of thrips per 5 tagged plants	Number of fruit borer per 5 tagged plants	Number of mites per 5 tagged plants	Number of aphids per 5 tagged plants
V_1M_0	1.69 i	2.54 g	2.72 jk	4.67i	2.07 fg
V_1M_1	0.58 l	1.00 k	1.41 n	1.16 n	0.62 k
V_1M_2	1.36 j	2.19 h	2.33 l	3.40 k	1.76 h
V_1M_3	0.88 k	1.56 j	1.89 m	1.81 m	1.12 j
V_2M_0	4.41 a	4.79 a	5.21 a	13.00 a	5.31 a
V_2M_1	3.48 d	3.71 d	3.89 e	8.66 c	3.84 d
V_2M_2	4.27 ab	4.52 b	4.41 b	9.45 b	4.98 b
V_2M_3	3.67 c	3.91 c	4.05 d	9.18 bc	4.55 c
V_3M_0	3.96 b	4.34 b	4.22 c	9.47b	4.83 b
V_3M_1	2.46 g	2.96 f	3.10 i	6.14 g	2.75 e
V_3M_2	3.31 d	3.62 d	3.67 f	8.29 d	3.34 d
V_3M_3	2.74 f	3.16 e	3.28 h	7.19 f	2.69 e
V_4M_0	3.08 e	3.29 e	3.38 g	7.63 e	3.45 d
V_4M_1	1.10 jk	1.91 i	1.97 m	2.59 l	1.41 i
V_4M_2	2.12 h	2.89 f	2.80 j	5.54 h	2.49 f
V_4M_3	1.54 i	2.30 h	2.39 l	4.09 ij	1.99 g
$LSD_{(0.05)}$	0.26	0.13	0.14	0.61	0.06
CV (%)	6.78	3.67	6.85	6.28	3.71

As a result, the order of rank of efficacy of the combination of varieties and treatments in terms of number of leaf, leaf length, leaf breadth, fruit length and fruit breadth was V_1M_1> V_1M_3> V_1M_2> V_4M_1> V_4M_3> V_1M_0> V_4M_2> V_3M_1> V_3M_3> V_4M_0> V_3M_2> V_2M_1> V_2M_3> V_3M_0> V_2M_2> V_2M_0. More or less similar research was also conducted by several researchers.

Effect on leaf and fruit yield of capsicum: The findings exposed that among the different Varieties, V_1 (comprised with California wonder) showed the best performance in case of number of leaves, length of leaves, breadth of leaves, length of fruits and breadth of fruits than the others. On the other hand in respect of mulching M_1 (Black polythene Mulching) showed outstanding performance for percent reducing the number of insect pests and getting the better growth and higher yield compared to those of other treatments (Table 3). Among the different combination of varieties and treatments, V_1M_1 (comprised with California wonderhot pepper + Black polythene mulching) showed the best performance in terms of number of leaf (49.44 leaves), leaf length (12.19 cm), leaf breadth (4.35 cm), fruit length (13.57 cm) and fruit breadth (4.80 cm) than the others (Table 4).

Table 3. Effect of different varieties and mulching on leaf and fruit yield of capsicum

Treatments	No. of leaf	Leaf length (cm)	Leaf breadth (cm)	Fruit length (cm)	Fruit breadth (cm)
Variety					
V_1	46.76 a	11.50 a	3.92 a	13.02 a	4.66 a
V_2	41.18 d	7.97 d	2.74 c	12.21 b	4.44 b
V_3	42.59 c	8.29 c	2.92 bc	12.23 b	4.50 a
V_4	42.97 b	9.43 b	3.29 b	12.58 b	4.53 a
$LSD_{(0.05)}$	0.20	0.31	0.43	0.36	0.23
CV (%)	1.32	4.83	10.17	5.85	4.50
Mulching					
M_0	41.47 d	9.03 a	3.07 a	11.97 a	4.45 a
M_1	44.45 a	9.44 a	3.34 a	12.86 a	4.63 a
M_2	43.56 c	9.31 a	3.22 a	12.61 a	4.51 a
M_3	44.02 b	9.41 a	3.25 a	12.62 a	4.53 a
$LSD_{(0.05)}$	0.23	0.74	0.54	1.20	0.34
CV (%)	1.32	4.83	10.17	5.85	4.50

Table 4. Combined effect of different varieties and mulching on leaf and fruit yield of capsicum

Treatments	No. of leaf	Leaf length (cm)	Leaf breadth (cm)	Fruit length (cm)	Fruit breadth (cm)
V_1M_0	45.13 e	9.51 c	3.33 bc	12.63 abc	4.60 abc
V_1M_1	49.44 a	12.19 a	4.35 a	13.57 a	4.80 a
V_1M_2	45.96 c	11.23 b	3.82 ab	13.09 ab	4.67 abc
V_1M_3	46.70 b	11.37 b	3.83 ab	13.11 ab	4.72 ab
V_2M_0	35.09 m	7.47 e	2.50 e	11.55 c	4.27 c
V_2M_1	42.61 i	8.79 cd	2.95 cde	12.33 abc	4.52 abc
V_2M_2	38.76 l	7.70 e	2.66 de	11.92 bc	4.28 c
V_2M_3	41.61 j	7.91 e	2.84 cde	12.08 bc	4.37 bc
V_3M_0	39.95 k	7.83 e	2.68 de	12.07 bc	4.32 bc
V_3M_1	44.03 h	8.95 cd	3.22 bcd	12.43 abc	4.55 abc
V_3M_2	41.68 j	8.15 de	2.85 cde	12.27 abc	4.46 abc
V_3M_3	44.45 g	9.14 c	3.24 bcd	12.54 abc	4.56 abc
V_4M_0	42.48 i	8.24 de	2.86 cde	12.29 abc	4.51 abc
V_4M_1	45.76 cd	11.21 b	3.67 b	13.04 ab	4.66 abc
V_4M_2	44.70 f	9.46 c	3.32 bc	12.55 abc	4.59 abc
V_4M_3	45.64 d	9.61 c	3.43 bc	12.73 abc	4.62 abc
$LSD_{(0.05)}$	0.23	0.74	0.54	1.20	0.34
CV (%)	3.78	4.83	10.17	5.85	4.50

Effect on fruit infestation of capsicum: V_1 (comprised with California wonder) showed the best performance in case of number of fruits, number of infested fruits, percentage fruit infestation by number, total fruit weight, infested fruit weight and percentage fruit infestation by weight than the others (Table 5). As a result, the order of rank of varieties of capsicum by weight was $V_1 > V_4 > V_3 > V_2$ as well as mulching basis $M_1 > M_3 > M_2 > M_0$. In respect of combined effect V_1M_1 (comprised with California wonderhot pepper + Black polythene mulching) showed the best performance in terms of number of fruit (17.33 fruits), number of infested fruits (1.12 fruits), percentage infested fruit by number (6.46 %), total fruit weight (2.04 kg), infested fruit weight (0.12 kg) and percentage fruit infestation by weight (5.88 %) than the others (Table 6). Always V_2M_0 noted the worst performances.

Table 5. Effect of varieties and mulching on fruit infestation of capsicum

Treatments	Number of fruit	Number of Infested Fruit	% fruit infestation by number	Total fruit weight(kg)	Infested fruit weight (kg)	% fruit infestation by weight
Variety						
V_1	14.22 a	1.92 c	13.50 a	1.22 a	0.25 c	20.49 d
V_2	12.21 b	4.08 a	33.42 d	0.97 b	0.41 a	42.27 a
V_3	13.15 b	4.05 a	30.80 c	1.03 b	0.33 b	32.04 b
V_4	13.41 b	2.53 b	18.87 b	1.05 ab	0.31 bc	29.52 c
LSD $_{(0.05)}$	0.29	0.20	1.03	0.17	0.05	1.32
CV (%)	1.46	6.97	4.32	7.72	11.62	9.21
Mulching						
M_0	11.98 d	3.93 a	32.81 a	0.90 b	0.37 a	41.11 a
M_1	15.31 a	2.40 d	15.68 d	1.20 a	0.26 c	21.67 d
M_2	12.62 c	3.40 b	26.94 b	1.01 b	0.36 ab	35.64 b
M_3	14.07 b	2.85 c	20.26 c	1.16 a	0.31 b	26.72 c
LSD $_{(0.05)}$	0.32	0.36	0.29	0.14	0.05	0.56
CV (%)	1.46	6.97	4.32	7.72	11.62	9.21

Table 6. Combined effect of different varieties and mulching on fruit infestation of capsicum

Treatments	Number of fruit	Number of Infested Fruit	% fruit infestation by number	Total fruit weight(kg)	Infested fruit weight (kg)	% fruit infestation by weight
V_1M_0	14.47 e	2.48 f	17.14 k	1.17 c	0.22 g	18.80 k
V_1M_1	17.33 a	1.12 i	6.46 p	2.04 a	0.12 h	5.88 p
V_1M_2	15.78 c	1.36 h	8.62 n	1.44 b	0.16 h	11.11 n
V_1M_3	16.58 b	1.34 h	8.08 o	1.46 b	0.14 h	9.59 o
V_2M_0	9.60 m	5.63 a	58.65 a	0.54 e	0.33 a	96.45 c
V_2M_1	12.30 hi	3.79 d	30.81 f	0.83 d	0.39 cd	46.99 e
V_2M_2	10.67 l	5.50 a	51.55 b	0.56 e	0.54 b	86.43 a
V_2M_3	12.09 ij	4.34 c	35.89 e	0.82 d	0.41 c	50.00 d
V_3M_0	11.79 jk	4.50 bc	38.17 d	0.64 e	0.49 b	76.56 b
V_3M_1	14.32 e	2.69 f	18.78 j	1.15 c	0.29 f	25.22 j
V_3M_2	12.53 h	3.58 de	28.57 g	0.92 d	0.35 de	38.04 g
V_3M_3	13.32 g	3.29 e	24.70 h	0.97 d	0.34 def	35.05 h
V_4M_0	13.73 f	3.28 e	23.89 i	1.13 c	0.33 ef	29.20 i
V_4M_1	14.31 d	1.77 g	12.37 m	1.43 b	0.18 gh	12.59 m
V_4M_2	11.67 k	4.73 b	40.53 c	0.60 e	0.24 b	40.00 f
V_4M_3	14.50 e	2.01 g	13.86 l	1.37 b	0.18 gh	13.14 l
LSD $_{(0.05)}$	0.32	0.36	0.23	0.14	0.05	0.46
CV (%)	1.46	6.97	7.81	7.72	11.62	9.35

Conclusion

From these above findings it was revealed that among the different combination of varieties and treatments, V_1T_1 comprised with California wonderhot pepper + Black polythene mulching showed the best performance in terms of number of fruit (17.33 fruits), number of infested fruits (1.12 fruits), percentage infested fruit by number (6.46 %), total fruit weight (2.04 kg), infested fruit weight (0.12 kg) and percentage fruit infestation by weight (5.88 %) than the others

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