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Natural Mulches Effect on the Yield of White Maize

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Authors' contributions

This work was carried out in collaboration among all authors. Author PAB designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors KUA and AMMS managed the analyses of the study. Author MMH managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The experiment was conducted at the experimental field of Sher-e-Bangla Agricultural University during the period from November 2015 to May 2016, Sher-e-Bangla Nagar, Dhaka-1207, to find out the effect of organic mulches on the yield of white maize. This experiment was comprised of two factors. Factor A: Variety (2): V1 = Shuvra; V2 = KS-510 and Factor B: Indigenous mulch materials (5): T1 = Control (without mulch); T2 = Water hyacinth; T3 = Rice straw; T4 = Rice husk; T5 = Ash. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications and the differences between means were separated by both Duncan's New Multiple Range Test (DMRT) and Least Significant Difference (LSD) test at 5% level of probability. Mulches showed significant effects on most of the parameters. In the case of variety, the highest grain yield (12.963ton per ha) was recorded from V2. Different organic mulch materials showed different values, the highest values were recorded from T3. Due to this (T3) mulch material. The water retentive capacity of the mulched soil was higher at all the stages of plant growth and ranked in the order of rice straw > water hyacinth > rice husk > ash > control. The highest grain yield (17.407ton per ha) was recorded from T3. . In case of interaction all yield attributing characters include grain yield (19.043ton per ha) was recorded from V2T3. So, KS-510 variety and rice straw mulch combinedly had outstanding superiority for morphophysiological and yield attributes in white maize over the other organic mulches.

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1. INTRODUCTION

Maize is one of the most important cereal crops in the world agricultural economy both as food for men and feed for animals including poultry. Maize can be considered and introduced as the first, an important cereal crop to meet up this requirement [1]. Maize is the highest grain yielding cereal crop compared to wheat, rice, and other cereals. Global maize production is highly concentrated within a few locations: Just four countries (United States, China, Brazil, and Argentina) produce 68% of the world's maize, and the top four maize-exporting countries combined (United States, Brazil, Argentina, and Ukraine) account for 87% of global maize exports [2]. Averaged over the 2012–2017 period, global annual maize exports were 125 million tons and global maize production was 986 million tons [2].The origin of maize in Mexico and now it is principle crop in many countries of temperate region.

Maize is a very important crop for malnutrition because it contains many nutrients such as carbohydrate, protein, fat, fiber, vitamin A, vitamin E, etc. which quantity is greater than wheat nutrient contains. It is consumed as flakes, bread, chapatti, powder, popcorn, cornflower, corn soup, sucrose (2.5%), corn oil, boiled corn, corn hotchpotch, corn biscuit, corn curry, corn cake, corn sweet, corn starch, corn porridge, Horlicks, boost, corn syrup, Mantova, canned sweet corn, etc. [3]. Young maize plants are also used as cattle feed and used for made thatched houses, organic matter, and fuel in different countries.

Nowadays white maize is very important because it is highly delicious and proteinaceous. The flour of white maize is so finer than yellow maize as a result it is the principal food of people of many countries in the world. More than 30 species have been discovered from these white maize. The types of delicious food are made from rice and wheat, similar types of food are also made from white maize.

Shuvra variety was different characteristics. The kernel color of the composite variety is white and semi-flint type. Ears are conical shaped. Plant height is higher than the local variety. Height of the ears 60-70cm. Grain white, large size, and ear fulfill with grain, the upper portion of the leaf is smaller than lower portion and comparatively narrow. Strong anthocyanin and 1st leaf sheath and medium pigmentation in leaf sheath at the 2-leaf stage. Developed by Bangladesh Agriculture Research Institute (BARI), Gazipur, Bangladesh. Method of development/origin. The variety was derived from the CIMMYT population (Mix.1×col. GPO.1) ×ETO. KS-510 variety was double-crossed hybrid, bold grain quality, stays green at maturity, good crop standability, and drought tolerant. It was developed by the proline seed company, India. Crop duration was medium, maturity period 90-100 Days, harvesting time after attaining physiological maturity.

The main characteristic of white maize is it needs only one irrigation as a result farmers get more yield with less cost. Mulching is a very useful practice to retain soil moisture in the crop fields. Organic mulches include formerly living material such as chopped leaves, straw, grass clippings, compost, wood chips, shredded bark, sawdust, pine needles, and even paper and also improve the soil as they decompose [4]. The lower-cost natural mulches are water hyacinth, rice straw, rice husk, ash are effective to retain soil moisture in the maize field. Water hyacinth *Eichhornia crassipes* (Pontederiaceae, Liliales) is a floating aquatic weed is considered as a valuable source of macronutrient such as phosphorous, nitrogen, potassium, that are indispensable for plant nutrition [5-8]. The mulching practice also enhanced the number of cob/plant, cob length, cob diameter, tassel length, number of seed row/cob, number of seed/row, the weight of rachis/cob, 1000 grain weight, grain yield, and higher Harvest Index (HI). The grain yield of rice straw and water hyacinth is more than double that unmulched plant under non-tilth conditions. The experiment was aimed to evaluate the natural mulches effect on the yield of white maize.

2. MATERIALS AND METHODS

2.1 Location of the Experiment

The experiment was carried out at the research field of Sher-e-Bangla Agricultural University (SAU), Dhaka-1207, during *Rabi* season from November 2015 to April 2016**.** The geographic coordinates of the experiment were AEZ- Madhupur Tract (28), General Soil Type-Shallow red-brown terrace soil, Land type-

Medium High land Soil series Tejgaon, Topography- Fairly leveled, Flood level- Above flood level, Drainage- Well drained.

2.2 Experimental Soil Characteristics

The topsoil of the experimental site is characterized by olive-grey with common fine to medium especially dark yellowish-brown mottle with silty clay in texture. Soil pH was 5.6 and organic carbon was 0.45% sufficient for maize production. The experimental area was of good drainage and irrigation system and above from flood level and the plot of experimental field was medium to high land. The physical and chemical properties of the initial soil were Sand 27 %, Silt 43 %, clay 30, Textural class silty-clay, Organic matter (%) 0.78, Total N (%) 0.03, Available P (ppm) 20.00, Exchangeable K (me/100 g soil) 0.10, Available S (ppm) 45 (Source: Soil Resources Development Institute (SRDI).

2.3 Experimental Materials

Two white maize varieties Shuvra(V_1) which is developed by BARI and KS-510(V_2) an Indian hybrid variety was used as plant materials. Natural mulches I. Water hyacinth II. Rice straw III. Rice husk IV. Ash. The treatments are: T_1= Control(without mulch),T_2= Water hyacinth,T_3= Rice straw, T_4= Rice husk, T_5= Ash.

2.4 Design and Layout of the Experimental Field

The experiment was set up in the field following the experimental design Randomized Complete Block Design (RCBD). The field was divided into 3 blocks to represent 3 replications. There were 30 unit plots altogether in the experiment. The size of each unit plot was 6 m^2 (3m × 2m). Distance maintained between replication to replication was 1m and plot to plot was 0.5m. Plant to plant distance maintained was 0.25 and row to row distance was 0.75m.

2.5 Application of Manure and Fertilizers

Cowdung was used as decomposed organic matter @ 6.0 ton per ha before final land preparation. Then the chemical fertilizers were applied as Urea, TSP, MOP, Gypsum, Zinc Sulphate, and Boric acid at the rate of 172-168-96-144-10 and 5 kg per ha in case of Shuvra and 500-240-180-240-10 and 5 kg per ha in case of KS-510 hybrid variety. All fertilizers and one-third portion of urea were applied as basal dose at the time of final land preparation. The rest of the Urea was applied after 30 DAS and 50 DAS at two installments.

2.6 Seed Treatment and Seed Sowing

Seeds were treated with Vitavex at the rate of 0.2% to 0.3% of seed weight. Seeds were sown in maintaining a row to row distance as per treatments having 2 seeds $hole^{-1}$ for Shuvra and 3 seeds $hole^{-1}$ for KS-510.

2.7 Mulch Materials Application

Mulch materials were applied on the field after seed sowing. There were four types of mulch materials these were water hyacinth, rice straw, rice husk, and ash. Mulches were applied at the rate of 10 ton/ha maintaining proper thickness in each plot.

2.8 Intercultural Operations

Thinning, gap filling, weeding, spraying of insecticides, fungicides, etc, were applied in the necessary time and also protect the crop from harmful things.

2.9 Data Recording and Analysis

Different morphophysiological and yield attributing parameters were recorded. All the collected data were tabulated and analyzed statistically using analysis of variance technique and subsequently Least Significance Difference (LSD at 5%) for comparing the treatment means, by MSTAT-C software [9].

3. RESULTS AND DISCUSSION

3.1 Seed Weight Cob^{-1}

Varietal effect significantly influences on seed weight/cob of maize. The maximum seed weight/cob (148.17 g) was found from V_2. On the other hand, the minimum seed weight/cob (139.61 g) was found from V_1. Variety V_2 performed better than V_1, it might be genetically influenced Table 1. Different mulches of materials significantly influenced on seed weight/cob of maize. The maximum seed weight/cob (168.47 g) was found in mulches treatment T_3 and it was statistically similar with T_2 (159.53 g) and T_4 (146.97 g). On the other

hand, the minimum seed weight/cob (114.07 g) was found in T_1 Table 1.Seed weight/cob significantly influenced by the interaction effect of different mulches and maize varieties. The maximum seed weight/cob (176.87 g) was recorded from the combination of V_2T_3 and it was statistically similar with V_2T_2 (5166.7g). On the other hand, the minimum seed weight/cob (1663.2 g) was recorded from the combination of V_1T_1 Table 2.

3.2 Per Cob Wt. (g)

Per cob, weight varied significantly for different maize varieties. The highest per cob weight (258.16 g) was obtained from V_2. On the other hand, the lowest per cob weight (242.37 g) was found from V_1 Table 1. Statistically, significant variation was recorded per cob weight due to different mulches. The highest per cob weight (299.77 g) was found from T_3, which was statistically similar to T_2 (284.17 g), whereas the lowest (189.17 g) was recorded from the control treatment (Table 1).Interaction effect of different mulches materials and maize varieties showed a significant variation on per cob weight. The highest per cob weight (310.87 g) was found from the combination V_2T_3, which was statistically similar to V_2T_3 (297.13 g), whereas the lowest (185.27 g) was observed from the combination V_1T_1 Table 2.

3.3 No. of Seeds Cob^{-1}

Significant variation in no. of seeds/cob was observed for maize varieties. V_2 was produced an increased number (218.80) of seeds/cob than V_1 (188.13) Table 1. Significant variation was observed for a number of seeds/cob due to different mulches of materials. The maximum number of seeds/cob (304.35) was found from T_3, which was statistically similar to T_2 (267.13), whereas the minimum number (95.35) was found from the control treatment Table 1. Rice straw mulches improved the soil condition and provide the best environment to the plant for nutrient uptake, so that plant can achieve the best growth rate and potential. Interaction effect of different mulches materials and maize varieties showed a significant variation on no. of seeds/cob. The highest no. of seeds/cob (572.13 g) was found from the combination V_2T_3, which was statistically similar to V_1T_3 (522.93 g), V_2T_2 (521.20) and V_2T_4 (517.47), whereas the lowest (408.60 g) was observed from the combination V_1T_1 Table 2.

3.4 Seed Weight Plant^{-1}

Seed weight/plant varied significantly for different maize varieties. The highest seed weight/plant (218.80 g) was recorded from V_2, whereas the lowest (188.13 g) was found from V_1 Table 1. Statistically, significant variation was recorded for seed weight/plant to different mulches materials. The highest seed weight/plant (304.35 g) was recorded from T3, whereas the lowest (95.35 g) was obtained from T1 Table 1. The combined effect of different mulches materials and maize varieties showed a significant variation on seed weight/plant. The highest seed weight/plant (330.67 g) was recorded from the combination of V_2T_3, while the lowest (92.43 g) was found from the combination of V_1T_1 Table 2.

3.5 Cob Length

The main effect of variety significantly affected the cob length of maize. However, the main effect of mulches, as well as the interaction effect of variety, significantly affects this parameter. Cob length increased significantly when the mulches were changed from control to water hyacinth to rice straw. Changing the mulches application beyond the rice straw didn't affect this parameter. Maximum cob length (21.62 cm) was recorded at the treatment T_3 and minimum cob length (17.98 cm) was at T_5 treatment Table 1. The highest cob length (23.02 cm) was recorded from the combination of V_2T_3, while the lowest (16.97 cm) was found from the combination of V_1T_5 Table 2.

3.6 Cob Diameter

The tallest cob diameter (5.08 cm) was obtained at the mulches treatment T_3 and the lowest (4.52 cm) was obtained at the mulches treatment of T_1 Table 1. The lower cob diameter obtained at the control mulches treatments might be due to retarded growth owing to limited moisture and nutrient availability. The result generally showed an increase in cob diameter of maize when mulches application from control to water hyacinth and rice straw application. A similar result was also found by Rahman [10] who reported that control or untreated plant gave the lower length and breadth of cob.

3.7 No. Of Row Cob^{-1}

The number of rows varied significantly for different maize varieties. The minimum number of row/cob (4.72) was found from V_1, whereas the maximum number (4.84) was obtained from V_2 Table 3. Different mulches varied significantly for a number of row/cob. The maximum number of row/cob (15.57) was recorded from T_3, whereas the minimum number (13.07) was from the control treatment. Significant variation was recorded due to the interaction effect of different mulches materials and maize varieties in terms of a number of row/cob. The maximum number of row/cob (15.73) was found from the combination of V_2T_3, which was statistically similar to V_1T_3 (15.40), whereas the minimum number (12.93) was observed from the combination of V_1T_1 Table 4.

3.8 No. of Seeds Row^{-1}

No. of seeds/row varied significantly for different maize varieties. The highest no. of seeds/row (34.96) was recorded from V_2, whereas the lowest (33.17) was found from V_1 Table 3. Statistically, significant variation was recorded for no. of seeds/row due to different mulches

Table 1. Effect of varieties and different natural mulches on seed wt. /cob, per cob wt., no. of seeds/cob, seed wt/plant, cob length, and cob diameter

Variety	Seed wt/cob (g)	Per cob wt (g)	No. of seeds/cob	Seed wt/plant (g)	Cob length (cm)	Cob diameter (cm)
V_1	139.61	242.37	462.96 b	188.13b	18.23b	4.72
V_2	148.17	258.16	510.37 a	218.80a	20.70a	4.84
$LSD_{(0.05)}$	ns	ns	36.149	23.568	0.78	ns
Mulch material ×						
T_1	114.07c	189.17d	417.03 c	95.35 d	18.11b	4.52 b
T_2	159.53a	284.17ab	507.53ab	267.13a	20.86a	4.95 a
T_3	168.47a	299.77a	547.53 a	304.35a	21.62a	5.08 a
T_4	146.97ab	248.33bc	494.10ab	208.60b	18.73b	4.78 ab
T_5	130.43bc	229.90c	467.13bc	141.90c	17.98b	4.56 b
$LSD_{(0.05)}$	24.42	37.98	57.15	37.26	1.23	0.33
CV (%)	13.99	12.51	9.68	15.10	5.22	5.61

V_1=Shuvra, V_2=KS-510, T_1=Control, T_2=Water hyacinth, T_3=Rice straw, T_4=Rice husk, T_5=Ash. In a column means having similar letter(s) are statistically similar and those having a dissimilar letter(s) differ significantly by LSD at 0.05 level of probability

Table 2. Interaction effect of varieties and different natural mulches on seed wt. /cob, per cob wt., no. of seeds/cob, seed wt/plant, cob length, and cob diameter

Variety × Mulch material	Seed wt/cob (g)	Per cob wt (g)	No. of seeds/cob	Seed wt/plant (g)	Cob length (cm)	Cob diameter (cm)
V_1T_1	111.73d	185.27f	408.60 d	92.43 d	16.46e	4.36 c
V_1T_2	154.93a-c	271.20a-d	493.87 a-c	247.07b	20.15bc	4.84 ab
V_1T_3	160.07a-c	288.67a-c	522.93ab	278.03ab	20.23bc	5.07 a
V_1T_4	141.80b-d	244.20b-e	470.73 bd	181.13c	17.34de	4.74 a-c
V_1T_5	129.53cd	222.53d-f	418.67cd	142.00cd	16.97e	4.57 bc
V_2T_1	116.40d	193.07ef	425.47cd	98.28 d	19.76c	4.67 a-c
V_2T_2	164.13ab	297.13ab	521.20ab	287.20ab	21.58ab	5.06 a
V_2T_3	176.87a	310.87a	572.13 a	330.67a	23.02a	5.09 a
V_2T_4	152.13a-c	252.47b-d	517.47ab	236.07b	20.12bc	4.81 a-c
V_2T_5	131.33b-d	237.27c-f	515.60ab	141.80cd	19.00cd	4.55 bc
$LSD_{(0.05)}$	34.54	53.72	80.83	52.7	1.74	0.46
CV (%)	13.99	12.51	9.68	15.10	5.22	5.61

V_1=Shuvra, V_2=KS-510, T_1=Control, T_2=Water hyacinth, T_3=Rice straw, T_4=Rice husk, T_5=Ash In a column means having a similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 level of probability

materials. The highest no. of seeds/row (37.87) was recorded from T_3, whereas the lowest (28.63) was obtained from the control treatment Table 3. Interaction effect of different mulches materials and maize varieties showed a significant variation on no. of seeds/row. The highest no. of seeds/row (39.80) was recorded from the combination of V_2T_3, which was statistically similar to T_2 (36.60), V_1T_2 (35.93) and V_1T_3 (35.93), while the lowest (27.40) was found from the combination of V_1T_1, which was statistically similar to V_2T_1 (29.87) Table 4.

3.9 1000 Seed Weight

Mulches application had a significant (P≤0.01) effect on thousand seed weight. The main effect of varieties and the mulches materials and interaction effect of the two factors influenced thousand seed weight of maize. When the mulches changes from control to water hyacinth to rice straw the thousand seed weight was increased. On the whole, plants grown at the rice straw mulches supply had seed weight highest than the seed weights of plants in the control treatment Table 3. Increased kernel weight in rice straw mulches might be due to the formation of more leaf area which might have intercepted more light and produced more carbohydrates in the source which was probably translocated into the sink (the grain) and resulted in more increased kernel weight than the control. Also, rice straw increases the enzyme activity in maize which may result in higher seed weight. Quayyum and Ahmed, [11] the highest weight of 1000 grains in maize with rice straw mulches significantly increased grain yield of maize conventionally tilled plots.

3.10 Seed Wt (t ha^{-1})

The main effect of variety and mulches materials was significantly ((P≤0.01) affected seed weight of the crop. However, the two factors also interact significantly to influence grain yield. The highest seed weight ton/ha was observed by variety V_2 (12.963ton/ha) Table 3. Mulches materials highly and significantly (P≤0.01) affected seed weight (t/ha). The highest seed weight (17.407 ton/ ha) was recorded from T_3, while the lowest (5.727 ton /ha) was obtained from the T_1 Table 3. When the mulches were changed from control to water hyacinth to rice straw, the seed weight of the crop was increased than decreased. Seed weight is a function of photosynthetic rate and proportion of the assimilatory surface area. Shen et al. [12] showed that mulches application significantly influenced seed weight. grain yields of Danyu86 in 2009 and Chaoshi1 in 2010 were significantly (LSD, P < 0.05) higher with straw mulching at the rate of 12 t ha– 1 than on the application of other treatments. The interaction effect between maize varieties and mulches materials was significantly affected on seed weight. The highest seed weight was observed in the combination with V_2T_3 (19.043 ton/ha), whereas the lowest seed weight was observed from the combination of V_1T_1 (5.543 ton/ha) Table 4.

3.11 Harvest Index (%)

The main effect of varieties significantly (P≤0.01) affected the harvest index of the crop. The highest harvest index was recorded for V_1 (0.53) Table 3. This indicates significantly higher biomass partitioning to grain production by this variety. The lower mean HI values in this experiment might indicate the need for the enhancement of biomass partitioning through genetic improvement. Significant differences in HI due to mulches materials were observed. Mulches treatment T_2 & T_4 both showed higher HI (0.58) Table 3. The lowest HI was observed by the treatment T_5 (0.44).

In developed countries in Europe and America, soil and water loss caused by forest fires and orchard management has attracted much attention [13-16]. Climate change has been showing important effects on crop production [17] and problems such as seasonal water shortages [18] and excessive evaporation [19] have become more serious. The key factor restricting the efficient utilization of cultivable land and limiting agricultural production is the scarcity of water resources in arid and semi-arid areas [20]. The NCP occupies 39% of the cultivated area of China but has only 8% of the nation's water resources [21]. Biodegradable mulch is increasingly being used as a substitute for plastic to avoid the negative effects of residual plastic mulch [22-24]. Costa et al. [25] assessed the performance of five biodegradable mulch films in strawberry production and compared these to conventional polyethylene (PE). They found that the biodegradable mulch had similar benefits in terms of productivity and quality when compared with PE. Gu et al. [23] tested PE film, biodegradable film, and non-film mulching of winter oilseed rape, and found that the yield, water-use efficiency, and grain quality did not differ significantly between biodegradable and PE films. Many researchers have reported that

covering the soil with transparent film mulch can improve soil temperatures, compared with not using mulch [26]. As a crop cultivation practice, mulching has been shown to significantly increase the yields of various crops and yield components: strawberry [27]; peach [28]; oilseed rape [23]; maize [29]; spring and autumn potato [30,31]; wheat [32]. Most studies of the mulching film on maize in China used transparent plastic film [33]. Khan and Parvej,[34] showed that by a field trial which was conducted on the four indigenous mulches viz. water hyacinth, rice straw, rice husk, and ash were used for this study under tillage and zero tillage condition. Mulching practices enhanced the number of cob plant–1, cob height, a number of seed rows cob–1 and seeds row–1, 1000–grains weight, the weight of rachis cob–1, grain yield, and higher harvest index (HI) in maize. The grain yield of mulched plants notably rice straw and water hyacinth was nearly double (8.73 t ha–1) than unmulched plants (4.93 t ha–1) under non–tilth condition. Sharma et al. [35] also reported that mulching increases corn productivity.

Table 3. Effect of varieties and different natural mulches on no. of row/cob, no. of seeds/row, 1000 seed wt., seed wt./ha and harvest index

Variety	No. of row/cob	No. of seeds/row	1000-seed weight (g)	Seed wt (t/ha)	Harvest Index (%)
V_1	14.11	33.17 b	283.53	11.105b	0.53
V_2	14.49	34.96 a	308.67	12.96a	0.52
LSD(0.05)	ns	1.77	ns	1.34	ns
			Mulch material×		
T_1	13.07 d	28.63 c	257.33c	5.73d	0.46 bc
T_2	14.70 b	36.27 a	311.33ab	16.02a	0.58 a
T_3	15.57 a	37.87 a	336.50a	17.41a	0.56 ab
T_4	14.40bc	35.13 ab	297.83ab	12.52b	0.58 a
T_5	13.77 c	32.43 b	277.50bc	8.50c	0.44 c
$LSD_{(0.05)}$	0.64	2.80	39.87	2.12	0.11
CV(%)	3.67	6.78	11.10	14.54	16.69

V_1=Shuvra, V_2=KS-510, T_1=Control, T_2=Water hyacinth, T_3=Rice straw, T_4=Rice husk, T_5=Ash. In a column means having a similar letter(s) are statistically similar and those having a dissimilar letter(s) differ significantly by LSD at 0.05 level of probability

Table 4. Interaction effect of varieties and different natural mulches on no. of row/cob, no. of seeds/row, 1000 seed wt., seed wt./ha and harvest index

Variety × Mulch material	No. of row/cob	No. of seeds/row	1000-seed weight (g)	Seed wt (t/ha)	Harvest Index (%)
V_1T_1	12.93 d	27.40 e	249.33c	5.54e	0.46 ab
V_1T_2	14.47 b	35.93 ab	298.33bc	14.82bc	0.56 a
V_1T_3	15.40 a	35.93 ab	305.00bc	15.77bc	0.54 a
V_1T_4	14.40 b	34.80 bc	297.33bc	10.88d	0.56 a
V_1T_5	13.33cd	31.80 cd	267.67c	8.52de	0.51 ab
V_2T_1	13.20 d	29.87 de	265.33c	5.91e	0.46 ab
V_2T_2	14.93ab	36.60 ab	324.33ab	17.22ab	0.60 a
V_2T_3	15.73 a	39.80 a	368a	19.04a	0.58 a
V_2T_4	14.40 b	35.47 bc	298.33bc	14.15c	0.60 a
V_2T_5	14.20bc	33.07 b-d	287.33bc	8.49de	0.38 b
$LSD_{(0.05)}$	0.9	3.96	56.38	3.002	0.150
CV (%)	3.67	6.78	11.10	14.54	16.69

V_1=Shuvra, V_2=KS-510, T_1=Control, T_2=Water hyacinth, T_3=Rice straw, T_4=Rice husk, T_5=Ash. In a column means having similar letter(s) are statistically similar and those having a dissimilar letter(s) differ significantly by LSD at 0.05 level of probability

Rahman, [10] showed the highest grain yield of 8.73 t ha–1 and the lowest of 4.93 t ha– 1with rice straw mulch and control treatments, respectively in a maize field. The highest (Harvest Index) HI from the rice straw mulch treated plot (0.60) and the lowest from the control plot (0.49) in maize.

4. CONCLUDING REMARKS

In terms of growth, yield contributing characteristics, and yield of white maize, the rice straw mulching, and variety KS-510 performed superior in the combination of different mulch materials and maize varieties. In the case of the Shuvra variety, which was next to KS-510 and was remarkable, a similar pattern of results was noticed. In the case of both varieties, the improved yield from the use of water hyacinth mulch was also noticed. The highest yield was given by straw mulch and the best yield and fair quantity were provided by water hyacinth mulch. Both the hyacinth mulches from straw and water performed better than the other mulches. To better yield and save irrigation costs, the use of mulch is recommended.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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