J Krishi Vigyan 2019, 8 (1) : 149-153 DOI : 10.5958/2349-4433.2019.00089.8

Influence of Different Planting Methods and Mulching on Growth and Yield of Spring Maize (*Zea mays* L)

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ABSTRACT

The field experiment was conducted to study the effect of different planting methods and mulching on the growth and yield of spring maize (*Zea mays L)*on sandy loam soil, low in organic carbon and available N and high in available P and K. The experiment was carried out in split plot design with twelve treatment combinations having three planting methods *viz.,* single row on bed (SR), double row on bed (DR) and paired row on bed (PR) in main plots and four live mulch treatments in sub plots including control, moong, mash and cowpea replicated four times. The results indicated that different planting methods and mulching had a significant effect on the growth and yield components of spring maize. The planting of maize with double row on bed gave significantly higher plant height, periodic leaf area index, dry matter accumulation, number of cobs per plant, number of grains per cob, straw yield and harvest index. Test weight was not influenced significantly. Grain yield (kg/ha) were also significantly more in double row on bed over paired row on bed but single row on bed was at par with it .Among the mulch plots mulching with cowpea recorded the highest growth and yield components. Test weight was not influenced significantly. Grain yield (kg/ha) was recorded maximum in cowpea mulch plots followed by moong, mash and least was in control plot.

Keywords: Legume, mulch, Planting methods, Spring maize, Yield components.

INDRODUCTION

Maize (*Zea mays L.*) is third leading cereal crop of the world after wheat and rice on basis of both area and production. In Punjab, maize was cultivated over an area of 114 thousand hectare with production of 423 thousand tonne yielding an average of 37.08q/ha during 2017-18 (Anonymous, 2019). Generally maize can be sown in two seasons *i.e., kharif* and spring, the spring maize is planted in first week of February requires frequent irrigations during its active growth phase in the months of April and May. In April and May evaporation demands of environment increases which enhances the water demand of crop. To overcome this increased evaporation demand, to increase the water use efficiency and to suppress the weed population agronomic practices like mulching, bed planting and sowing pattern may be helpful.

For successful establishment of the spring maize, mulching has beneficial effects such as water conservation due to reduction in evaporation loss of soil water (Teame *et al*, 2017; Kumar and Lal, 2012). Other reason for mulching use includes soil temperature modification (Kumar *et al*, 2014), increasing the soil organic carbon (Bajoriene *et al*, 2013; Kumar *et al*, 2014), nutrient addition (Patil *et al*, 2016) and improvement of soil properties (Kumar, 2014). Thus, it facilitates more retention of soil moisture and helps in control of temperature fluctuations, improve physical, chemical and biological properties of soil, as it adds nutrients to the soil and ultimately enhances the growth and yield of crops. Thus present study was, therefore, planned to determine the influence of different planting methods and mulching on growth and yield components of spring maize.

MATERIALS AND METHODS

The experiment was conducted during spring season. The average annual precipitation of

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experimental site is about 75 cm, the major part of which is received during the months of July to September with a few showers of cyclonic rains during winter months. The soil was sandy loam in texture (69.8, 15.4, 14.8% sand, silt and clay at 15-30 cm depth respectively) with normal pH (7.9). The experiment was conducted with split plot design comprised of three planting methods *viz;* single row on bed (SR), double row on bed (DR) and paired row on bed (PR) in main plots and four live mulch treatments in sub plots including control, moong, mash and cowpea, replicated four times with a gross plot size of 5.4m x 5.4m. Field was ploughed twice with a tractor drawn disc harrow and twice with a cultivator followed by planking, when it comes to optimum moisture conditions. The pre treated seeds of variety PMH 8 were sown by kera method. On the same day mulch crops such as cowpea, moong and mash with 12.5 kg/ha seed were also sown in between the rows of spring maize as per treatment.

The plant height of five randomly selected plants from each plot was measured from soil surface to the base of the top most leaf. Plant height was measured at 30d interval. Similarly, leaf area of five randomly selected plants was recorded manually from each plot at 90d after sowing. Leaf area index was calculated by dividing leaf area with ground area of plant. For dry matter accumulation, two plants were periodically cut from soil surface from each plot and sun dried, and then, kept in oven at 65^0C up to a constant weight. After drying in the oven, dry weight of plants was recorded and converted into q/ha. Data on different growth and yield components (number of cobs per plant, number of grains per cob, test weight, grain yield, straw yield and harvest index) were recorded at the time of harvesting. The grain and straw yield from each net plot (4.05 × 4.05) was recorded at the time of harvesting and converted to q/ha basis. Measurement from each plot was averaged before statistical analysis. Analysis of variance (ANOVA) was carried out on the data to determine the influence of different planting methods and mulching through agronomic manipulations for various measurements using CPCS-1 software developed by the Department of Mathematics and Statistics PAU, Ludhiana and adapted by Cheema and Singh (1991). LSD test at 5% probability was used to compare the difference among treatments.

RESULTS AND DISCUSSION

Plant height

The data showed that plant height was significantly affected by planting methods (Table1). Maize planted at DR produced taller plants (183.9 cm) which was at par with SR (180.4 cm). The lowest plant height was recorded for PR (170.8 cm). Higher plant height associated with spring maize grown at double row on bed was probably due to uniform distribution of plants and decreased inter plant competition. These results were in line with Hassan *et al* (2013). Similarly cowpea mulching in maize produced significantly tallest plants (188.0 cm) which was at par with moong and significantly higher than mash mulching (181.9 cm and 176.2 cm). The lowest plant height was recorded for control plots (166.5 cm). The probable reason may be that cowpea mulch has more biomass which suppressed the weed and reduced weed growth. Therefore, the competition for light, water and nutrient was less in cowpea mulching which helped in promoting the plant height. Similar results were also reported by Reddy *et al* (2009) who found higher plant height of baby corn with intercropping of legumes. This might be due to symbiotic relationship between crops resulting in better plant growth.

Leaf area index (LAI)

The LAI was higher (3.32) in double row on bed, but it was closely followed by single row on bed (3.15). However, the lowest values for LAI were recorded in paired row on bed (2.68). The higher leaf area index in double row on bed was probably due to better interception of light by the crop. These results were supported by the findings of Hassan *et al* (2013) and Ahmed *et al* (2010). The treatment having cowpea mulching produced higher LAI (3.40) over other treatments. The

Table 1. Effect of different planting methods and mulching on growth and yield components of spring maize (*Zea mays* L.) at harvest stage.

Treatment	Plant height (cm)	Leaf Area Index (90 DAS)	Dry matter accumulation (q/ha)	Number of cobs per plant	Number of grains / cob	Test Weight (g)	Grain Yield (q/ha)	Straw Yield (q/ha)	Harvest Index (%)
Planting methods									
SR	180.4	3.15	124.5	1.39	356.1	256.2	37.3	89.7	29.3
DR	183.9	3.32	127.5	1.42	366.0	258.4	38.4	90.2	29.8
PR	170.8	2.68	119.2	1.28	323.9	249.1	33.5	85.7	28.1
CD (p=0.05)	8.3	0.41	4.9	0.07	28.3	NS	3.55	3.60	1.0
Mulching									
Control	166.5	2.50	117.2	1.23	320.3	245.6	32.7	84.5	27.9
Mash	176.2	3.05	122.5	1.34	343.4	254.9	36.5	88.6	29.1
Moong	181.9	3.25	125.7	1.40	360.7	257.7	37.4	89.8	29.4
Cowpea	188.0	3.40	130.0	1.47	370.1	259.9	38.9	91.1	29.9
CD (p=0.05)	9.1	0.30	5.0	0.09	20.4	NS	2.37	2.2	0.6
Interaction	NS								

lowest LAI was obtained with control plots (2.50). Enormous increase in LAI under live mulching was due to increase in rate of cell division and cell size enlargement under high availability of soil water (Xie*et al*, 2006; Kumar and Lal, 2012) to crop and better soil health condition due to legume mulching (Sharma *et al*, 2010).

Dry matter accumulation

Maize grown at double row on bed exhibited higher DMA (127.5 q/ha) at harvest, which was at par with single row on bed (124.5 q/ha) planting method but significantly higher than the paired row on bed (119.2 q/ha), planting method. Higher dry matter accumulation in double row on bed than paired row might be due to more solar radiation interception by crop plants and efficient utilization of available resources which led to better crop growth. Similar results were also concluded by Hassan *et al* (2013). Similarly, minimum (117.2 q/ha) DMA was obtained in control plots. The cowpea mulching gave maximum (130.0 q/ha) DMA when compared with other treatments. This might be due to nodulation under live mulch improve soil nutrient status (Sharma *et al*, 2010), helped in suppressing weed growth, and led checking evaporation losses (Narain and Singh, 1997) resulted in better growth attributing characters and ultimately maximum dry matter yield obtained under live mulching.

Number of cobs per plant

The maize crop planted at double row on bed produced (1.42) cobs per plant, which were 10.9 per cent more than paired row on bed (1.28) but statistically at par with single row on bed (1.39). Similarly, maximum number of cobs per plant (1.47) was recorded in cowpea mulching plots, while minimum cobs per plant (1.23) were noted in control plots. This might be due to the faster growth of vegetable cowpea which smoother weed growth during initial stages and have symbiotic relationship. These results corroborate with the findings of Reddy *et al* (2009).

Number of grains per cob

The higher number of grains per cob (366.0) was recorded in maize planted at double row on bed followed by single row on bed planting method (356.1) and minimum number of grains per cob (323.9) was observed in paired row on bed. Cowpea

mulching in maize performed better and produced more number of grains per cob(370.1) which were statistically at par with moong and mash mulching but significantly higher than control (no mulch). Therefore, the treatments having no mulch were inferior and produced lowest number of grains per cob. This might be due to the more weed growth in control plots.

Test Weight

The perusal of the data revealed that test weight was non-significantly affected by planting methods and mulching. However numerically higher test weight was observed in double row followed by single and paired row. Similarly, trend of test weight was in favor of cowpea followed by moong, mash and control.

Grain Yield

The perusal of the data revealed that different planting methods had a significant influence on the grain yield of spring maize. Higher grain yield of 38.4 q/ha was recorded in double row on bed planting which was 2.94 percent higher than single row on bed and 14.6 percent higher than paired row on bed planting(Table 1). Single row on bed (SR) and double row on bed (DR) plantings were at par with each other in respect of grain yield and both these methods were significantly better than paired row on bed planting. Increased grain yield in double row on bed planting was due to better growth parameters (plant height, leaf area index and dry matter accumulation) and yield attributes (number of cobs per plant, number of grains per cob).Similar results were also observed by Hassan *et al* (2013) who reported that in double row on bed planting method there was probably better light interception, more nutrients and moisture uptake which contributed more LAI, CGR and yield attributes and resulted into the higher grain yield. Jaidka *et al* (2018) revealed a significant and highly positive correlation of maize cob weight, cob weight, grain weight per cob and cob girth at top with grain yield of maize hybrids.

Similarly, cowpea mulching recorded highest grain yield of spring maize (38.9 q/ha) which was significantly higher than the mash mulching (36.5 q/ha) and control plot (32.7 q/ha) however it was at par with moong mulching (37.4 q/ha). Further, maize yield in moong and mash mulching were at par with each other but these both produced higher yield than the control plots (no mulch). This may be due to enriching the soil with organic matter and nitrogen through *Rhizobium symbiosis*. Similar results were obtained by Caamal-Maldonado *et al* (2001).

Straw yield

The Maize planted in double row on bed recorded highest straw yield 90q/ha which was numerically higher than single row on bed and paired row on bed planting. Single row on bed and double row on bed planting were statistically at par with each other and both these methods were significantly better than paired row on bed planting. Cowpea, moong and mash live mulching produced significantly higher straw yield than the control (no mulch). Maximum straw yield (91.1q/ha) was recorded with cowpea mulching which was closely followed by moong mulching but significantly higher than mash mulching. The straw yield in moong and mash mulched plots were statistically at par with each other but superior over control plot (no mulch). Straw yield was increased by 7.8, 6.2 and 4.8 per cent in cowpea, moong and mash mulching respectively, over control plots. More straw yield in cowpea mulching plots might be due to more vegetative growth of the cowpea plants as compared to other mulching and control plots.

Harvest index

Maximum harvest index (29.8%) was recorded for maize in double row on bed planting as against the minimum (28.1%) in paired row on bed (Table 1). This might be due to in the double row planting method interplant competition was decreased. Research conducted by Saberi *et al* (2014) showed similar results. Similarly, more harvest index value

(29.9%) were observed in cowpea mulching plots to maize crop over control plots (27.9 %) respectively.

CONCLUSION

From present study it can be concluded that planting methods and mulching had significant effect on growth and yield components of spring maize. Double row on bed planting method and cowpea mulching should be used to get better growth and yield of spring maize.

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Received on 16/07/2019 Accepted on 03/11/2019