Cercetări Agronomice în Moldova
Vol. XLVI , No. 1 (153) / 2013

EFFECT OF DIFFERENT SOWING TECHNIQUES AND MULCHES ON THE GROWTH AND YIELD BEHAVIOR OF SPRING PLANTED MAIZE *(ZEA MAYS* L.)

M.S.I. ZAMIR[1]*, G. YASIN[1], H.M.R. JAVEED[1], A.U.H. AHMAD[1], A. TANVEER[1], M. YASEEN[2]

*E-mail: zamir757@gmail.com

Received November 16, 2012

ABSTRACT. A field trail was carried out to evaluate the effect of different sowing techniques and mulches on the growth and yield attributes of maize. The experiment was conducted at the Agronomic Research Farm, University of Agriculture, Faisalabad during spring season, 2011. The experiment was laid out in randomized complete block design (RCBD) with split plot arrangement having three replications with net plot size of 7.0 m × 4.5 m. Field experiment comprised of five sowing methods (S_1: ridge sowing, S_2: ridge sowing alternate double sided, S_3: bed sowing, S_4: furrow sowing and S_5 flat sowing) and three mulches (M_1: maize pith, M_2: wheat straw, M_3: rice straw) was conducted during 2011 spring season under the tropical condition. The results showed that cobs length, cob diameter, and number of grains per cob, 1000-grain weight, biological yield and grain yield were maximum under ridge sowing method (S_1) following the ridge sowing alternate double sided (S_2). Furrow sowing shows least response to the agronomic and yield related parameters of spring maize. Among the mulch treatments; wheat straw mulch (M_2) perform better and gave higher grain yield (6.21 Mg ha^{-1}) as compared to the rice straw mulch and maize pith. Sowing techniques and mulches showed statistically non significant results for quality parameters (starch contents, oil contents and protein contents). Interaction of all three quality parameters was also observed non significant.

Key words: Sowing techniques; Mulches; Hybrid maize yield; Tropical condition; Pakistan.

INTRODUCTION

World population is increasing day by day which is a serious threat to food security. This can be overcome by enhancing production of major crops. Maize is staple food in most part of the world and has third

[1] Department of Agronomy, University of Agriculture, Faisalabad, Pakistan
[2] Institute of Soil and Environmental Sciences, University of Agriculture, Faisalabad, Pakistan

position after wheat and rice because of its high yielding potential and short duration crop in Pakistan. Major areas of Pakistan regarding to production of maize are KPK and Punjab. Total area under maize cultivation in Pakistan was 939 thousand hectares with yield of 3341 thousand tones (GoP, 2011). Developing countries like Pakistan, India, Iran are facing great challenges to meet input resources i.e., fertilizer, irrigation, good quality seed and energy crisis in order to sustain their production.

There is need to adopt such practices and combination of organic and inorganic sources to decrease the cost of production. The practice of spreading plant residues or any other material like straw on the soil surface to reduce water evaporation losses is called mulching. Appropriate tillage and mulch practices are used to conserve soil moisture and increase the yield of crops. Crop residues at the soil surface act as shade which serves as a vapor barrier against moisture losses from the soil, causing slow surface runoff. Rathore *et al.* (1998) reported that more water conserves in the soil profile during the early growth period with straw mulch than without it. Subsequent uptake of conserved soil moisture, moderated plant water status, soil temperature and soil mechanical resistance, leading to better root growth and higher grain yields. Applications of crop residue mulches increase soil organic carbon contents (Saroa and Lal, 2003).

Of the agronomic practices, planting technique is of considerable importance as proper adjustment of plants in the field not only ensures optimum plant population, but also enables the plants to utilize the land and other input resources more efficiently and resolutely towards growth and development (Ali *et al.*, 1998). Maize planted on ridges performed better than that grown in single-rows. Planting patterns significantly influence growth and yield of maize. Days taken to tasseling, grain weight per cob, 1000-grain weight, dry stalk weight, and harvest index and grain yield were affected significantly by the planting geometries (Tollenaar and Aguilera, 1992).

Keeping this in view, the present investigation was planned to determine the effect of different sowing techniques in combination with mulch application on growth and yield behavior of spring planted maize.

MATERIALS AND METHODS

The study was conducted at Agronomic Research Area, University of Agriculture, Faisalabad, during spring 2011. Experiment was laid out in randomized complete block design (RCBD) with split plot arrangement having three replications. Soil analysis was done before the sowing of the crop and after the harvesting of the crop. The net plot size was 3.6 m × 5 m. The experiment was comprised of five sowing methods viz. ridge sowing (S_1), ridge sowing double sided (S_2), bed sowing (S_3), furrow sowing (S_4), flat sowing (S_5)

and three different mulches viz. maize pith (M_1), wheat straw (M_2) and rice straw (M_3). Maize hybrid 32F10 was used as an experimental material. Standard procedures were adopted for recording growth, yield and quality parameters. Mulching material (wheat straw mulch, rice straw mulch and maize straw mulch) was applied in the field after the sowing of the maize. Data was analyzed statistically and treatments means were compared by using least significant difference test (LSD) at 5% probability level. Standard procedures were adopted for recording the data of agronomic and yield related parameters.

RESULTS AND DISCUSSION

Plant population per plot at harvest

Plant population is a key factor for better crop yield. Plant population is directly influenced by germination count of the crop, as shown in *Table 1*. Germination is affected by the environmental factors and seed purity itself. The results revealed that different sowing techniques and mulches have non-significant effect on plant population. The results are in accordance with Amin *et al*. (2006), who reported that plant population was not significantly influenced by planting techniques and mulches.

Table 1 - Plant population per plot of maize at harvest affected by different sowing techniques and mulches

Sowing techniques	Mulches			Means
	M_1	M_2	M_3	
S_1	126.66	127.66	126.00	126.78
S_2	126.66	127.00	125.00	126.22
S_3	124.33	127.33	125.66	125.78
S_4	124.66	125.66	125.33	125.22
S_5	123.33	125.00	125.66	124.67
Means	125.13	126.53	125.53	

Number of grains per cob

Number of grains per cob directly relate with the yield of the crop. Significant results were observed for sowing techniques and mulches, as indicated in *Table 2*. The results shows that from sowing techniques, ridge sowing (S_1) perform better and give 320.33 numbers of grains per cob. Furrow sowing (S_4) shows least response and give 275 numbers of grains per cob. Results were same as reported by Mahmood *et al*. (2001), who reported that highest numbers of grains per cob were observed in those treatments where crop was sown on ridges.

Table 2 - Number of grains per cob affected by different sowing techniques and mulches

Sowing techniques	Mulches			Means
	M_1	M_2	M_3	
S_1	302.67 bcd	348.00 a	310.33 bc	320.33
S_2	301.33 bcd	314.67 b	285.00 de	300.33
S_3	287.00 cde	300.00 bcd	269.67 ef	285.56
S_4	256.67 f	289.33 cde	279.00 def	275.00
S_5	266.67 ef	289.00 cde	286.33 de	280.67
Means	282.87	308.20	286.07	

1000-grain weight (g)

Grain yield of maize is directly correlated with 1000-grain weight. Among various yield related parameters, 1000-grains weight has prime importance, as mentioned in *Table 3*. The data shows that there was a significant difference among the different sowing techniques for 1000-grain weight. Ridge sowing method (S_1) was observed most suitable method because it gave maximum 1000-grain weight (369.13 g). Similar results were presented by Majid *et al*. (1986), who reported that crop sown on ridges performed better than other sowing methods.

All the mulch treatment affects 1000-grain weight. Maximum 1000-grain weight (336.57 g) was observed in those treatments where wheat straw mulch was applied, whereas minimum 1000-grain weight was observed where maize pith was used as a mulch material. These results are in agreement with those of Gill and Aulakh (1990).

Table 3 - 1000-grain weight (g) affected by different sowing techniques and mulches

Sowing techniques	Mulches			Means
	M_1	M_2	M_3	
S_1	364.93 bc	399.81 a	342.64 c	369.13
S_2	357.52 bc	387.04 ab	341.35 cd	361.97
S_3	344.18 c	305.19 e	295.50 ef	314.96
S_4	307.09e	290.85 ef	299.16 ef	292.34
S_5	309.16 de	296.84 ef	271.03 F	299.03
Means	309.94	336.57	335.95	

Grains yield (t/ha)

Grain yield is also called as economic yield. It is cleared from the data that different sowing techniques and mulches significantly influence the grain yield, as shown in *Table 4*. Maximum grain yield (6.21 t/ha) was observed in those treatments where ridge sowing method (S_1) was adopted. The reason of more grains yield might be that maize crop sown on ridges may be attributed to the greater amount of available nitrogen to plants than other sowing methods. Similar results were observed by the Brown *et al.* (1985), who reported that maize crop sown on ridges performed better than other sowing methods in case of grain weight.

Table 4 - Grains yield (t/ha) affected by different sowing techniques and mulches

Sowing techniques	Mulches			Means
	M_1	M_2	M_3	
S_1	5.71	6.94	5.99	6.21 A
S_2	5.22	6.25	5.31	5.59 B
S_3	4.02	4.97	4.55	4.51 C
S_4	3.83	3.85	3.81	3.83 D
S_5	4.17	4.58	4.53	4.43 C
Means	4.59 B	5.32 A	4.84 AB	

CONCLUSION

It is concluded that for better sowing of maize crop, ridge sowing method should be adopted along with wheat straw as mulching material to sustain or improve soil productivity.

REFERENCES

Ali M., S.K. Khalil, S. Ayaz, M.I. Marwat, 1998 - Phenological stages, flag leaf area, plant height, and leaves per plant of corn influenced by phosphorus levels and plant spacing. Sarhad J. Agric. 14: 515-522.

Amin M., A. Razzaq, R. Ullah, M. Ramzan, 2006 - Effect of planting methods, seed density and nitrogen, phosphorus fertilizer levels on sweet corn (*Zea mays* L.) J. Res. Sci. 17(2): 83-89.

Brown P., 1985 - Maize (*Zea mays* L.) cultivation trials 1982-83. Nyasald.Fmr. For. 4, pp:13-17

Gill K.S., B.S. Aulakh, 1990 - Wheat yield and soil bulk density response to some tillage systems on an Oxisol. Soil Till. Res. 18(1): 37-45.

Government of Pakistan, 2011 - Economic survey of Pakistan 2010-11. Ministry of food, agriculture and livestock (federal bureau of statistics), Islamabad, pp: 1.

Mahmood M.T., M. Maqsood, T.H. Awan, S. Rashid, R. Sarwar, 2001 - Effect of different levels of nitrogen and intra-row plant spacing on yield and yield components of maize. Pak. J. Agric. Sci. 38: 48-49.

Majid A., M. Shafiq, M. Iqbal, 1986 - Deep tillage and sowing techniques in maize production under high

rainfed condition. Pak. J. Agric. Res. 7: 181-185.

Rathore A.L., A.R. Pal, K.K. Sahu, 1998 - Tillage and mulching effects on water use, root growth and yield of rainfed mustard and chickpea grown after lowland rice. J. Sci. Food Agric. 78: 149-161.

Saroa G.S., R. Lal, 2003 - Soil restorative effects of mulching on aggregation and carbon sequestration in a Miamian soil in Central Ohio. Land Degrad. Dev. 14: 481-493.

Tollenaar M., A. Aguilera, 1992 - Radiation use efficiency of old and new maize hybrids. Agron. J., 84: 536-541.