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Short Communication

Effect of Nitrogen and Seed Size on Maize Crop. I: Stand and Plant Height

AHMAD KHAN[1], AMANULLAH JAN, SAJIDA BASHIR AND MAMMONA NOOR
Department of Agronomy, NWFP Agricultural University Peshawar, Pakistan
[1]Corresponding author's e-mail: ahmad0936@yahoo.com

ABSTRACT

The present study was designed to investigate the effect of nitrogen and seed size on plant height and crop stand in maize. Four seed sizes i.e. small, medium, large (having diameter of 0.5 cm, 0.6-0.7 cm & 0.8-1.0 cm, respectively) and composite (not graded) and four N levels 0, 60, 120 and 180 kg ha^{-1} were tested in the experiment. Maximum plant height, number of plants m^{-2} and low percent mortality was recorded with 120 N kg ha^{-1}. Larger seeds resulted in maximum emergence m^{-2}, plant height, number of plants m^{-2} and low mortality percent. It may be concluded that 120 N kg ha^{-1} and large seed size of maize showed best performance under the agro-climatic condition of Peshawar.

Key Words: Nitrogen; Seed size; Maize; Plant height

INTRODUCTION

Maize (*Zea mays* L.) is an important cereal crop of the North West Frontier Province (NWFP) of Pakistan. It is grown on a total area of 961.7 thousands ha, with a total production of 1652 thousand tones and average yield of 1718 kg ha^{-1} in Pakistan (MINFAL, 2002). Though the existing varieties and hybrids of maize have a high yield potential, soil and climatic conditions of Pakistan is very ideal for its production, but still yield per hectare is very low as compared to many growing countries of the world. This low crop productivity may be due to improper use of inputs like poor seed quality, non-judicious use of fertilizer, improper plant protection measure and non-availability of irrigation water. Quality seed plays an important role in germination and seedling vigor and ultimately grain yield. The size of seed can influence the growth of maize. Large seed having more indigenous food reserve are capable to produce vigorous plant (Howe & Schupp, 1985; Ellison, 1987). Small seeds although capable of germination do not seem to be as vigorous as large seed nor do they maintain viability in storage as well. Moreover, the presence of small seeds seems to reduce the apparent value of a seed lot. The size of seed may be different for different species or even in the variety of the same crop because of both genotype and phenotype differences. Varying single nutrient like N can increase the maize seed size (Eck, 1984). The positive relationship between nutrient supply and seed weight may simply be a reflection of a higher growth rate of the seed during the filling period.

In order to bridge this gap in maize productivity, the package of production technology involving the use of recommended dose of N fertilizer and appropriate seed size may lead to increase maize crop stand and ultimately maize production.

The present study on maize variety Kissan-92 was carried out with aim to determine the effect of seed sizes and nitrogen levels on crop stand of maize.

MATERIALS AND METHODS

The experiment was carried out at Agricultural Research Farm, NWFP Agricultural University Peshawar in kharif 2002. Maize variety Kissan-92, obtained from store seed of Agricultural Research Farm NWFP Agricultural University Peshawar was used in the experiment. Four levels of N i.e. 0, 60, 120 and 180 kg ha^{-1} and four seed sizes i.e. small, medium, large (sieved through 0.5 cm, 0.6-.07 cm and 0.8-1.0 cm, respectively) and composite (without sieving). The larger seed size had a moisture content of 13%, medium had 12% small had of 11% and composite had 12%, while the initial germination in the laboratory were 95, 90, 85 and 90%, respectively for large, medium, small and composite seeds.

The experiment was laid out in randomized complete block design with split plot arrangement placing nitrogen in the main and seed sizes in the subplots. Crop was sown in plot size of 5x3.5 m having 70 cm apart 5 rows, with 20 cm plant to plant distance by hand hoe at seed rate of 30 kg ha^{-1}. The soil was a silty clay loam, well drained and strongly calcareous, with a pH of 8.2, deficient in nitrogen and phosphorous but has adequate potassium. Organic matter was less than 1%. Phosphorus @ 60 kg ha^{-1} was applied as a basal dose single super phosphate (SSP), while Nitrogen was applied in split application once at sowing time and with first irrigation. Uniform agronomic practices were

followed for all the treatment. The data were recorded on emergence m^{-2}, plant height, number of plants ha^{-1} and percent mortality.

RESULTS AND DISCUSSION

No of plants emerged m^{-2}. N levels failed to affect the emergence (Table I). It might be due the storage capability of the seed, which resulted in emergence irrespective of nitrogen application at very early stages of the crop. Maximum emergence m^{-2} was recorded with large seed size compared to all others seed sizes that might be due to the greater storage food material in large seed which resulted in maximum emergence. As bold seed size is indication of high vigor. This finding is in similarly with Galecic (1993), who reported maximum germination in large size seed and was further confirmed by Moreno *et al.* (1998), who reported 31% more germination in large seeds as compared to small size seed.

Plant height (cm). N significantly improved plant height. Minimum plant height (134.61 cm) was measured in control plots while maximum plant height (160.14 cm) was recorded in plots applied with 120 kg N ha^{-1}. These results are in line with Shirvay and Singh (2000) who reported that decrease in N will decrease plant height and reported maximum plant height with 120 N kg ha^{-1} level. Significantly minimum plant height (144 cm) was recorded when small size seed was used, while maximum plant height was recorded in large seed size. The large size seed may have produced strong and early seedling, which enhance vegetative and reproductive development and give a healthy and tall plants.

Number of plants at harvest. Nitrogen significantly affected number of plants at harvest. The minimum plants ha^{-1} (3.71) was recorded in plots that received no nitrogen. Increasing fertilizer doses to 60, 120, 180 kg ha^{-1} increased the number of plants at harvest but at par statistically with each other. Minimum number of plants at harvest is the result of poor emergence as evident from number of plants m^{-2}. Like wise significantly maximum plants at harvest ha^{-1} (4.03) were recorded with large size seed, which are statistically similar to each other, while the lowest plants (3.80) were recorded with small size seed may be due to weakness of seedling to maintain population. This finding is in similarity with Martinelli (1999) who suggested that seed sizes and genotypes may compensate plants population.

Percent mortality. Various nitrogen levels and seed size affected the percent mortality significantly. Maximum mortality (47%) was recorded in plots that received no nitrogen. It might be the result of increased mortality due to non-availability of sufficient nitrogen for better establishment of plants while in fertilized plots less mortality was noted which were statistically similar to each other. The small seed size having maximum mortality (48%), while low mortality percentage was recorded with large, which similar to composite and medium size seed.

Table I. Effect of N and seed size on emergence, growth and mortality of maize genotype Kissan-92

Factors Levels	No. of Plants emerged m^{-2}	Plant height (cm)	No plants of at harvest m^{-2}	Percent mortality
		Nitrogen levels (kg ha^{-1})		
0	12	134.61 b	3.80 b	47 a
60	15	152.77 a	4.02 a	43 b
120	17	160.14 a	4.03 a	43 b
180	15	153.19 a	4.02 a	43 b
LSD at 5 %	NS	16.49	0.07	0.96
		Seed sizes (cm)		
Small	13 b	144.00 c	3.71 b	48 a
Medium	15 b	151.61 ab	4.06 a	43 b
Large	17 a	158.87 a	4.06 a	43b
Composite	14 b	147.74 bc	4.05 a	44 b
LSD at 5 %	1.5	7.52	0.08	1.15

Means followed by one letter in common in the same category are not significantly different statistically at P≤0.05.

These might be due to seedling non-capability to sustain their life in plots of small size seed. This finding is in similarity with Martinelli (1999) who suggested that seed size may compensate crop stand.

CONCLUSION

On the basis of these observation, it may be concluded that nitrogen level 120 kg ha^{-1} and large seed size responded better in yield and other characteristics and may be recommended for higher productivity after testing for other characteristics under varied climatic condition and circumstances.

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