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INFLUENCE OF PLANTING DENSITIES AND NUTRIENT LEVELS ON SWEET CORN GENOTYPES IN NORTH EASTERN HIMALAYAN REGION OF INDIA

Sanjenbam Dayananda Singh[1], Jeti Konsam[2], Nabakishor Nongmaithem[3],

Pushparani Senjam[4] and Diana Samurailatpam[5]

ABSTRACT

A field experiment was conducted at Andro research farm, Central Agricultural University, Imphal, India during *kharif* season of 2018 to study the performance of sweet corn genotypes under varying planting densities and nutrient levels. The experimental results observed that higher planting density (66,000 plants ha^{-1}) recorded significantly higher cob yield, green fodder yield, net return and B:C ratio of the crop. Among different nutrient levels, application of 120:60:60 kg N:P:K ha^{-1} was recorded higher net return and B:C ratio. The genotype Madhuri gave significantly higher cob yield, green fodder yield, plant height, cob length, cob girth, kernel rows cob^{-1}, kernels row^{-1}, seed index, net return and B:C ratio. Therefore, from the above results, it can be concluded that cultivation of sweet corn genotype Madhuri with planting density of 66,000 plants ha^{-1} and nutrient level of 120:60:60 kg N:P:K ha^{-1} is recommendable option for sweet corn production in the region.

(Key words : Sweet corn, planting density, yield, economic)

INTRODUCTION

In the North eastern Himalayan region of India, maize is the second most important crop, next to rice and is mostly grown under rainfed hilly upland conditions. In the region, maize production plays a significant role in ensuring food security and is used both for direct consumption as well feed for piggery and poultry but the productivity is far below the national average. Among the several reasons for low productivity are adoption of traditional low yielding genotypes (Patiram, 2007), erratic distribution of rainfall (Choudhary *et al.,* 2013), improper spacing or density, unaware in application of fertilizers (Enzung and Jamir, 2019), lack of transport and market facilities, resource poor small and marginal farmers. It is observed that maize is grown without any proper spacing .

Sweet corn is one type of maize that contains 13 to 15% sugar in immature grains. It can be harvested within 80 to 90 days after sowing. They are harvested earlier by 35 to 45 days and higher market value (Khadtare *et al.,* 2006) compared to normal grain corn. There is an increasing tendency to produce sweet corn for higher income generation of the poor and marginal farmers of the region. However, lack of knowledge in its usage, economic importance, non-availability of appropriate production technology (like optimum spacing and nutrient management) is the major constraints for its popularization among farmers in the region. The optimum plant density is an important factor for intercepting sunlight for harvesting maximum solar radiation and higher photosynthesis besides, efficient use of plant nutrients and soil water. Maize is more affected by variations in plant density than other member of the grass family (Vega *et al.,* 2001). Low soil fertility is one of the bottlenecks to sustain agricultural production and productivity (Negassa *et al.,* 2007). Optimizing the NPK fertilizer doses is necessary to achieve optimal yield potential of cultivars. Hence, the present experiment was conducted to study the performance of sweet corn genotypes to different planting densities and NPK levels.

MATERIALS AND METHODS

The experiment was conducted at Andro research farm, Central Agricultural University, Imphal, Manipur, India during *kharif* season of 2018 to study the response of sweet corn genotypes to varying planting densities and nutrient levels on growth, yield and economics of the genotypes. The soil of the experimental field was sandy clay loam soil having 5.71 pH, 1.72 % organic carbon, 279 kg ha^{-1} available nitrogen, 20.7 kg ha^{-1} available phosphorus and 133 kg ha^{-1} exchangeable potassium. Total rainfall received during the crops growth was 1474 mm. An average maximum and minimum temperature of 32 ^{o}C and 19 ^{o}C was recorded during the entire growing period. The experiment was laid out in split-split plot design with two planting densities (55,000 plants ha^{-1} and 66,000 plants ha^{-1}) in main plots, two nutrient levels (120:60:60 and 180:90:90 kg NPK ha^{-1}) in sub plots,

1 Asst. Agronomist, AICRP- Maize, College of Agriculture, Central Agricultural University, Imphal
2 Asst. Entomologist, AICRP- Maize, College of Agriculture, Central Agricultural University, Imphal
3 Asst. Pathologist, AICRP- Maize, College of Agriculture, Central Agricultural University, Imphal
4 Jr. Plant Breeder, AICRP- Rapeseed and Mustard, College of Agriculture, Central Agricultural University,Imphal
5 Jr. Agronomist, AICRP- Rapeseed and Mustard, College of Agriculture, Central Agricultural University, Imphal

four sweet corn genotypes (Mathuri, Priya AKSH4 and Win orange) in sub-sub plots having three replications. The crop was planted in 12th July, 2018. Urea, single super phosphate and muriate of potash were the fertilizers used. Out of these 50% nitrogen, 100% phosphorus and potassium were applied as basal and remaining 50% nitrogen was split first at knee height and at tasseling stage. The observations on plant height at harvesting, number of days to 50 % tasseling, number of days to 50% silking, length of the cobs, length of the cob girth, number of kernel rows cob^{-1}, number of kernels row^{-1}, 100 seed weight (seed index), cob yield and green fodder yield were recorded. Economics were calculated according to market price of the sweet corn. The statistical analysis was done as per procedure suggested by Gomez and Gomez (1983).

RESULTS AND DISCUSSION

Growth and yield attributes as affected by plant density, nutrient levels and sweet corn genotypes

The experimental results in Table 1 revealed that plant height at harvesting stage, number of days to 50 % tasseling, number of days to 50% silking, length of the cobs, length of the cob girth, number of kernel rows cob^{-1} and number of kernels row^{-1} were not affected by planting densities and nutrient levels. But the sweet corn genotypes were significantly influenced on growth and yield attributes. Among the genotypes, Madhuri gave higher plant height (204.0 cm) at harvest, minimum number of days to tasselling (55.2 days) and silking (57.8 days) than other genotypes. Similarly, length of the cob, girth of the cob, kernel rows cob^{-1} and kernel row^{-1} were attributed to Madhuri genotype followed by Priya genotype. Genotypic character of different genotypes might have attributed difference in plant height (Biswas *et al.,* 2019).

Yield and seed index as affected by plant density, nutrient levels and sweet corn genotype

Higher planting density (66,000 plants ha^{-1}) recorded highest cob yield (8408 kg ha^{-1}) and green fodder yield (16186 kg ha^{-1}). Similarly, Biswas *et al.* (2019) reported the yield advantages of sweet corn in higher planting density as compared to lower plant density. The positive relationship between yield and plant density was due to the high number of ears harvested and high number of plants $unit^{-1}$ area, though yield $plant^{-1}$ was high in lower plant density due to better interception of sun light, higher radiation and nutrients use efficiency (Dawadi and Sah, 2012). There was no marked influence of cob yield and green fodder yield due to higher nutrient level as compared to lower level of nutrient applied (Table 2). Among the genotypes, Madhuri showed maximum cob yield (10039 kg ha^{-1}) and fodder yield (18163 kg ha^{-1}) followed by Priya which recorded cob yield of 8461 kg ha^{-1} and fodder yield of 16219 kg ha^{-1}. Higher yield of maize realized from genotype Madhuri might be due to its genetic make-up. Genotypic variations in yield were also reported by Patil *et al.* (2000) and Ahmad *et al.* (2010). The 100 seed weight (seed index) of the genotypes was not influenced due to varied planting densities and nutrient levels. However, among the genotypes, AKSH4 was superior in terms of seed index (16.0 g) followed by Win orange (14.5 g).

Net return and B: C ratio as affected by plant density, nutrient levels and maize genotypes

There was marked influence on net return and B:C ratio due to plant densities, nutrient levels and maize genotypes. In respect of economics, higher planting density (66,000 plant ha^{-1}) recorded highest net return (Rs. 112259/- ha^{-1}) with B: C ratio of 2.69. This might be due to higher green fodder yield and cob yield under higher plant density that led more B: C ratio and crop productivity. Biswas *et al.* (2019) reported the higher monetary returns in higher planting density as compared to lower density. Lower nutrient level produced higher net return (Rs. 105725 /- ha^{-1}) and B: C ratio (2.72) than higher nutrient levels. Lesser monetary return in higher nutrient levels might be due to higher cost of cultivation in applying higher doses of fertilizers. Among the genotypes, Madhuri recorded maximum net return (Rs. 140327/- ha^{-1}) and B: C ratio (3.40) than other genotypes. This might be due to the fact that this genotype having greater potential to produce more green fodder and cob yield resulting in greater return amongst other genotypes.

From the experimental results, it can be concluded that, cultivation of maize genotype Madhuri with planting density of 66,000 plants ha^{-1} and nutrient level of 120:60:60 N, P_2O_5 and K_2O kg ha^{-1} is a recommendable option for achieving higher yield and economic benefit during *kharif* season under north eastern hill region of India.

Table 1. Influence of planting densities and nutrient levels on growth and yield attributes of sweet corn genotypes

Treatments	Plant height (cm)	Days 50% tasseling	Days 50% silking	Cob length (cm)	Cob girth (cm)	Kernel rows cob^{-1}	kernels row^{-1}
Density (plants ha^{-1})							
55000	189.1	55.9	58.6	16.9	13.5	12.4	32.3
66000	193.4	55.4	58.8	17.3	14.3	12.7	30.9
SE(m)±	2.0	0.1	0.1	0.4	0.1	0.1	1.2
CD (P=0.05)	-	-	-	-	-	-	-
Nutrient Levels (kg ha^{-1})							
120:60:60	191.3	55.7	58.7	17.2	14.0	12.7	31.3
180:90:90	191.2	56.0	58.6	17.1	13.8	12.4	31.9
SE(m)±	2.2	0.2	0.1	0.2	0.1	0.4	0.8
CD (P=0.05)	-	-	-	-	-	-	-
Genotypes							
Madhuri	204.0	55.2	57.8	20.3	15.4	13.1	33.2
Priya	185.6	55.8	58.7	17.1	14.5	12.5	32.4
ASKH 1	187.0	56.5	59.3	15.1	12.9	12.1	30.0
Win Orange	188.4	56.0	58.8	16.0	12.8	12.4	30.8
SE(m)±	3.0	0.2	0.2	0.4	0.3	0.2	1.2
CD (P=0.05)	6.7	0.6	0.6	1.1	0.7	0.6	-

Table 2. Influence of planting densities and nutrient levels on yield and economics of sweet corn genotypes

Treatments	Cobs yield (kg ha^{-1})	Green fodder yield (kg ha^{-1})	Seed Index (g)	Net returns (Rs. ha^{-1})	B:C ratio
Density (Plants ha^{-1})					
55000	6935	12996	14.4	85495	2.10
66000	8408	16186	13.9	112259	2.69
SE(m)±	180.6	314.3	0.4	2546.7	0.1
CD (P=0.05)	1098.9	1912.1	-	15495.5	0.4
Nutrient Levels (kg ha^{-1})					
100% RDF	7975	14469	14.4	105725	2.72
150% RDF	7368	14712	13.9	92028	2.08
SE(m)±	164.9	168.8	0.2	2330.5	0.1
CD (P=0.05)	-	-	-	9150.8	0.2
Genotypes					
Madhuri	10039	18163	13.4	140327	3.40
Priya	8461	16219	12.7	113594	2.75
ASKH 1	5884	10704	16.0	65207	1.58
Win Orange	6301	13276	14.5	76379	1.85
SE(m)±	223.0	458.1	0.3	3390.2	0.1
CD (P=0.05)	650.1	1337.8	1.0	9895.3	0.2

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