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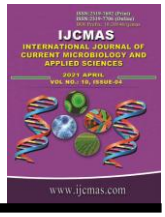

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Harvest Index (HI) as Influenced by Total Grain Yield and Biological Yield in K-27 Variety of Maize Crop (*Zea mays* L.) under Varying Levels of Nitrogen and Plant Growth Regulators (PGR)

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A B S T R A C T

Maize is one of the most important cereals of the world with its average yield of 27.8 q/ha. Maize ranks first among the cereals and is followed by rice, wheat and millets with average grain yield of 22.5, 16.3 and 6.6 q/ha, in India respectively. In Indian condition especially soil and climate, harvest index of most of varieties of maize ranges between 28 to 50% where as in some part of the world which are known for maize production, it ranges from 50-70% in USA. An experiment was conducted at Department of Agronomy, SHUATS, Naini, Prayagraj (Allahabad), U.P. in 2019-20. The soil of the experimental plots was sandy loam with low carbon contents of 0.35%, medium in available nitrogen and phosphorus i.e. 230 kg and 20 kg/ha and low in potassium contents i.e. 189 kg/ha with 6.7 PH. Prayagraj has subtropical and semi-arid climatic conditions with both extremes of temperature i.e. winter and summer. Minimum temperature during January may dip to 9-10 ^{0}c minimum and maximum to 23-24 0c whereas during May it reaches to 41-42 ^{0}c. In our present study, there were 12 treatments in 3 replications i.e 80 kg,100 kg and120kg nitrogen /ha with three PGR, NAA @40 ppm, Mepiquat Chloride @200 ppm and Putrescine @ 50 ppm. It was recorded that treatment 10 (120 kg nitrogen with 40ppm NAA) has resulted into maximum yield (5015.33 kg/ha with maximum stover yield (9162.07)kg/ha which resulted into harvest index of 35.37%, however, HI closely ranged between 35.37 to 36.27 % in all the 12 treatments. Thus, it may be concluded that under similar soil and climatic, managemental conditions in particular geographic conditions, effect of varying levels of nitrogen and use of different Plant Growth Regulators (PGR) resulted in significant variations in grain yield and total biological yield of maize but least effect on harvest index (HI).

Introduction

Among the cereal crops, maize has the highest grain yield potential, the biomass above the ground represents crop's accumulated photosynthesis products while harvest index represents the efficiency of crops to convert photosynthesized products into an

economically valuable form. Corn stover is made up of stalk leaves, husk and tassels left in the field after harvesting the grain stover can be harvested and used as a livestock feed, converted into ethanol or for generation of electricity. The amount of stover each crop year depends on weather, soils and management practices. As a general rule, the amount of stover produced is about the same as the amount of grain produced which is expressed in ratio called harvest index. In a study at Michigan, USA it was found that on an average harvest index would be 0.50 in a normal year i.e. without weather extremes. There is wide variation in data reported in USA (0.35-0.79). During excessively wet or dry years when grain yields are reduced, the harvest index is usually lower i.e. higher stover yield than grain yield under normal climatic conditions hovers around 0.50. With advancement in breeding, genetics and more intensive management, higher crop yield can be achieved with same size plant, resulting in higher harvest index. A new opportunity arise for harvesting corn stover for livestock feed or for bioenergy, farmers will want to keep better track of how much stover they have left in the field after harvest, it is simple estimate to judge how much stover has been produced.

Materials and Methods

Experiment was carried out in Randomized Block Design (RBD) having 12 treatments combinations with tree replications on sandy loam soil having 7.4 pH, low organic carbon i.e. 0.03% and medium NPK at Department of Agronomy, SHUATS, Prayagraj, U.P. The experimental maize variety used was K-27which is high yielding variety recommended for Uttar Pradesh (U.P.). The crop was grown during Rabi season in 12019-20 at Crop Research Farm of the university. For grain yield, cobs from net plots were harvested and shelled. Grain obtained after shelling was weighed and presented in kg/ha, stover yield, plants were cut just above the soil surface in net plot area and weighed which was reported in kg/ha. For biological yield, the value of total grain yield /ha was added with the value of stover yield /ha. Harvest index was calculated using following formula:

Harvest Index (HI) = Grain yield (kg/ha/ Biological yield (kg/ha)

Statistical Analysis

Data obtained was analyazed by Fishers method of Analysis of Variance (ANOVA) given by Gomez and Gomes (2010). Critical Difference (CD) Value were calculated whenever the F-test was found significant at 5% level.

Results and Discussion

Maize productivity in India raise from 1.9tonnes /ha in 2004 -05 to 2.5 tonnes/ha in 2013-14 which is still lower than major maize growing countries of the world. The maize is cultivated throughout year in all the states of the country for various purposes including grain, fodder, oil, baby corn, pop- corn in peri-urban areas including industrial uses. Maize in India contributes nearly 9% in the food basket. In present study significantly higher yield of 5015.33 kg/ha was recorded in treatment 10 (120 kg/ha nitrogen +NAA @40ppm) which was closely followed by treatment 6 and 12 where 100 kg/ha nitrogen with Putrescine @50 ppm, respectively. The increase in these components seems to have been brought about by increase in amount of growth and yield attributes substances and naturally occurring phytohormones with increased nitrogen supply to the plant. Yield improvement in treatment 10 might be due to an early and plentiful availability of nitrogen leading to better nutritional environment in the root zone for growth and development as nitrogen is one of the major plant nutrients required for growth.

Table.1 Effect on grain, stover yield and harvest index of maize

Treatment Details	Grain yield (kg/ha)	Stover yield (kg/ha)	Harvest index (%)
80 kg/ha Nitrogen	3,563.333	6,285.633	36.189
80 kg/ha Nitrogen + NAA 40 ppm	4,226.667	7,691.967	35.461
80 kg/ha Nitrogen + Mepiquat Chloride 200 ppm	3,138.667	5,510.947	36.277
80 kg/ha Nitrogen + Putrescine 50 ppm	4,173.333	7,580.967	35.503
100 kg/ha Nitrogen	3,933.667	6,922.657	36.232
100 kg/ha Nitrogen + NAA 40 ppm	4,778.000	8,696.707	35.461
100 kg/ha Nitrogen + Mepiquat Chloride 200 ppm	3,699.667	6,510.297	36.232
100 kg/ha Nitrogen + Putrescine 50 ppm	4,712.333	8,577.604	35.461
120 kg/ha Nitrogen	4,122.000	7,295.503	36.101
120 kg Nitrogen + NAA 40 ppm	5,015.333	9,162.073	35.377
120 kg Nitrogen + Mepiquat Chloride 200 ppm	3,921.000	6,913.404	36.189
120 kg Nitrogen + Putrescine 50 ppm	4,962.000	9,014.913	35.503
F-test	S	S	S
SE(m)	94.531	165.294	0.082
CD(p=0.05)	279.039	487.918	0.243

Nitrogen is an element of chlorophyll, it harnesses solar energy and fixes atmosphericCo2 as carbohydrates and amino acids. Thus, nitrogen application increased dry matter production. The increased supply of nitrogen and its higher uptake by the plants might have stimulated the rate of various physiological processes in plant and leads to increased growth and yield attributes (Sofi *et al.,* 2004; Yadav and Pandey, 2005; Chillar and Kumar, 2006; Sahoo and Mahapatra, 2007; Gul *et al.,* 2015, Rahman *et al.,* 2016; Pandey *et al.,* 2017, Suryavanshi *et al.,* 2020).Stover yield was also recorded significantly higher in treatment 10 and followed the same pattern in treatment 6 and 12, respectively. Increase in fodder yield due to NAA spray might be due to increase in plant height, leaf area index and total biomass due to increased cell division, cell enlargement and elongation. In the present study, it was 9162.07 kg/ha in treatment 10 followed by 8696.7 kg/ha and 9014.91 kg/ha in treatment 6 and 10, respectively. Suryavanshi *et al.,* 2020, however reported 4594kg/ha which is lower stover yield which might have been due to variation in variety, season, soil composition and geographical location of crop. Present findings are well agreement with Hirpara *et al.,* 2017, they have reported stover yield of 8478 kg/ha from south Saurashtra, Gujarat, India.

Data perusal from table No.1.revealed that harvest index of K-27 variety of maize was 36.27% in treatment 3 (Nitrogen 80kg/ha+Mepiquat Chloride 200 ppm) which was not much different from treatment s 1,5,7,9 and 11 statistically. Suryavanshi *et al.,* 2020 have also reported harvest index of 38.37%, further they have stated that HI was influenced by many factors and ranged from 35.39 to 41.85% whereas it ranges from 30% to 60% in major maize growing regions of

USA. Porter and Semonob (2005) have reported that supra-optimal temperature during anthesis reduces seed setting which leads to sink limitation and decreased harvest index. High temperature during crop season might have affected translocation efficiency which resulted into poor harvest index. The weak source-sink relationship due to temperature was also reported by Suwa *et al.,* (2010). Present findings are also in agreement with those of Shreshtha *et al.,* (2016) and Jasemi *et al.,* (2013).

Present experimental results demonstrated that Harvest Index (HI) of K-27 variety of maize resulted into HI of 35.37-36.27% which is lower in comparison major maize growing areas of USA and Europe. Application of appropriate doses of nitrogen with Plant Growth Regulators (PGR) improved crop growth rate and better harvest index though it varies significantly depending upon soil condition, geographical location and climatic conditions prevailing during span of crop growth and maturity.

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