EFFECT OF NITROGEN LEVELS ON THE GROWTH AND YIELD OF SPRING MAIZE

ABSTRACT

The research entitled the "Effect of different nitrogen levels on the growth and yield of spring maize" was conducted in the agriculture research farm of Lovely Professional University, Phagwara. Three different doses of nitrogen are used at different concentrations from lowest to highest. The doses of Nitrogen are denoted as N1, N2 and N3. The first dose of Nitrogen is N1 which is the application of 80Kg N/ha. The second dose of Nitrogen is N2 which is the application of 120 Kg N/ha. The third dose of Nitrogen is N3 which is the application of 160 Kg N/ha. All the doses of nitrogen are compared with each other for the measurement of morphological parameters like plant height, the number of leaves and dry weight accumulation. In yield parameters, the grain yield, test weight, stower yield and shelling percentage was calculated. From the experiment, it was observed that the highest results were found in the treatment with the highest nitrogen dose with 160 Kg N/ha. The morphological parameters like plant height, number of leaves per plant and dry weight accumulation were found highest in N3 which is 160Kg N/ha. The yield parameters like grain yield, shelling percentage, stower yield and test weight are also found high in the treatment with the application of the highest amount of nitrogen that is 160Kg N/ha. From this research, the best results are provided by N3 which is 160 Kg N/ha, after that the moderate results are provided by N2 which is 120Kg N/ha and the least results were provided by N1 which is 80Kg N/ha.

KEYWORDS: Effect, Grain, Growth, Nitrogen, Shelling, Yield.

INTRODUCTION

Maize is regarded as one of the most important cereal crops and provides as a source of food to most of the human population. Maize also provides a major source of income to most of the farmers (Zamir et al., 2012). Maize is a crop that provides a very high yield and produces a large number of maize grains per unit area. Maize is a short duration crop and is cultivated in two seasons within a year is in the spring season which is spring maize and the second one is in autumn season (Iqbal et al., 2015). Maize also provides a very good nutritional value. The protein present in maize in zein is gluten-free and contains 70-75% starch, 3% sugars, 5% oil, 10% proteins, 8-9% fibres and 2% ash content in it. With the rise in the green revolution, the use of chemical fertilizers also gets increased and it will reduce the gap within the nutrient use efficiency (NUE) and the crop yield (Li et al., 2021). This all occurs due to the increased demand for food and increasing population. With the rise in the green revolution, farmers started to use excessive fertilizers to get a high amount of yield. But the excessive use of fertilizers is not able to maintain the yield for many years and later on degrades the environment and soil health also by reducing the nitrogen use efficiency (Ali, N& Anjum, M.M., 2017). The proper management of fertilizers and their application rates should be properly managed and should be according to the demands of the crop for maintaining the productivity of crop and to avoid nutrient losses. Among all the macro-nutrients like Nitrogen, Phosphorus and Potassium etc. (Aslam et al., 2013). Nitrogen is the most limiting macronutrient for production in agriculture. Because all the crops require nitrogen in a very good quantity than other nutrients for their proper growth and development. The application of Nitrogen is different for different crops (Woldesenbet, M & Haileyesus. A., 2016). For different crops, there is different timing of application of fertilizers. The timing of the application of nitrogen is very important and the use of slow-release of nitrogen fertilizers is important for better productivity. The use of slow-release fertilizers is more effective than other fertilizers because the slow-release fertilizers fulfil the crop

nutrient requirement for the proper physiological functioning (Amin, M.E.M.H., 2011). Single-use of the slow-release fertilizers is enough to meet the requirement of nutrients to the crop plants than the multiple applications (Shirazi et al., 2014). The slow-release fertilizers help in increasing the yield of maize crops and improve the nutrient use efficiency of crop therefore it also reduces the cost of labour. The yield of maize grain and the yield of maize biomass increase (Asif et al., 2013). The use of slow-release fertilizers can also increase the photosynthetic rate and other physiological reactions. This will enhance the enzymatic activities like carbon assimilation and nitrogen assimilation that are going on in the plants and also reduce the volatilization of ammonia which increases yield (Mukhtar et al., 2011). There is a specific amount of fertilizer used for achieving the good results of spring maize and it completely depends upon the time of application, type of application and the type of fertilizer used. Like maize can be grown as a cereal crop as well as a forage crop (Khan et al., 2014). The biomass of maize is used as a fodder crop which can fulfil the fodder requirement for animals mainly in the winter season. Maize is regarded as a very good fodder crop because the leaves of maize contain a very good amount of protein and energy as compared to the other forage crops mainly in cereals crops (Farhad et al., 2009). The complete plant of maize is used for the fodder for the animals used for dairy and beef purposes. The green plants of maize are used for fodder because they are short-duration crops as well as they can obtain the vegetative parts in a very short period (Karkia et al., 2020). Maize is a very quick growing crop having high nutrition value and high dry matter accumulation. The dry matter yield of spring maize depends upon genetic and environmental factors (Rasheed et al., 2004). The environmental factors like available soil water and the temperature are the most important factors on which the dry matter yield and development of leaf area depends. In the production of forage crops, the leaf area and the structure of the canopy are most important (Onasanya et al., 2009). In forage crops, the dry

matter accumulation is very high whereas the leaf area index is less. It was also proved that if the leaf area index is more than 5 then the accumulation of dry matter is mainly on the stem part of the plant. Nitrogen plays a very important role in the better productivity of crops like maize. But its deficiency also produces a limiting factor for the production of cereal crops (Eltelib et al., 2006). The grains of maize crops have a positive response towards nitrogen. The linear relationship is seen in between the doses of nitrogen applied with the silking, tasseling and maturity stage of the maize crop. The deficiency of nitrogen in the maize crop or any other crop reduces the leaf area index because of the reduction in the light interception and hence causes a reduction in grain yield (Imran et al., 2015). With the proper supply of nitrogen to the crop or soil, the quality characteristics like protein content also get improved. The very low and very high doses of nitrogen to the crop affect the grain quality of maize. So, it is necessary to provide an optimum dose of nitrogen and other nutrients to the crop plant for its proper growth and development and for maintaining the quality characteristics of the crop (Abouziena et al., 2007).

METHODOLOGY

The research experiment was conducted under the Department of Agronomy, School of Agriculture, Lovely Professional University, Phagwara, District Kapurthala, Jalandhar, Punjab. The research experiment is a field experiment that is successfully done under the agronomy field of the school of agriculture. The lovely professional university is located 360Km far away from New Delhi, which is the capital of India. The field trial is conducted in the sub-tropical zone of the central plains of Punjab. The trial is performed under different planting densities and different doses of nitrogen on the spring maize crop. The design used for this experiment is a randomised block design.

CLIMATIC CONDITIONS

The research experiment site of Lovely Professional University Phagwara comes under subtropical regions of India. The annual rainfall recorded at the experimental site is about 200-1000mm/year. The highest temperature observed in the experimental site is 480C. The temperature required for the proper growth and development of spring maize is 18-280C.

TREATMENTS DETAILS

The treatment used for the research purpose is nine in number with three replications. The variety used for the field experiment is DKC 9108 PLUS and is taken from the local seed shop located in Phagwara, Punjab. There are three planting densities with P1= 60×21cm, P2= 60×18cm and P3= 60×15cm and three different levels of nitrogen N1= 80Kg N/ha, N2= 120Kg N/ha and N3= 160Kg N/ha are used. Treatment T1 is the application of 80kg nitrogen with 79365 plants per hectare. The spacing used is 60×21cm. Treatment T2 is the application of 120kg nitrogen with 79365 plants per hectare with the spacing of 60×21cm. Treatment T3 is the application of 160kg nitrogen with 79365 plants per hectare. The spacing used is 60×21cm. Treatment T4 is the application of 80kg nitrogen with 92592 plants per hectare. The spacing used is 60×18cm. Treatment T5 is the application of 120kg nitrogen with 92592 plants per hectare. The spacing used is 60×18 cm. Treatment T6 is the application of 160kg nitrogen with 92592 plants per hectare. The spacing used is 60×18cm. Treatment T7 is the application of 80kg nitrogen with 1,11,111 plants per hectare. The spacing used is 60×15cm. Treatment T8 is the application of 120kg nitrogen with 1,11,111 plants per hectare. The spacing used is 60×15cm. Treatment T9 is the application of 160kg nitrogen with 1,11,111 plants per hectare. The spacing used is 60×15cm (Table 1).

Table.1. TREATMENT DETAILS

TREATMENTS	TREATMENTS DETAILS

T1	79,365 plants /ha (60 X 21 cm) + 80 kg N2 ha-1
T2	79,365 plants /ha (60 X 21 cm) + 120 kg N2 ha-1
T3	79,365 plants /ha (60 X 21 cm) + 160 kg N2 ha-1
T4	92,592 plants /ha (60 X 18 cm) + 80 kg N2 ha-1
T5	92,592 plants /ha (60 X 18 cm) + 120 kg N2 ha-1
T6	92,592 plants /ha (60 X 18 cm) + 160 kg N2 ha-1
T7	1,11,111plant / ha (60 X 15 cm) +80 kg N2 ha-1
T8	1,11,111plant / ha (60 X 15 cm) +80 kg N2 ha-1
T9	1,11,111plant / ha (60 X 15 cm) +80 kg N2 ha-1

OBSERVATIONS TO BE RECORDED

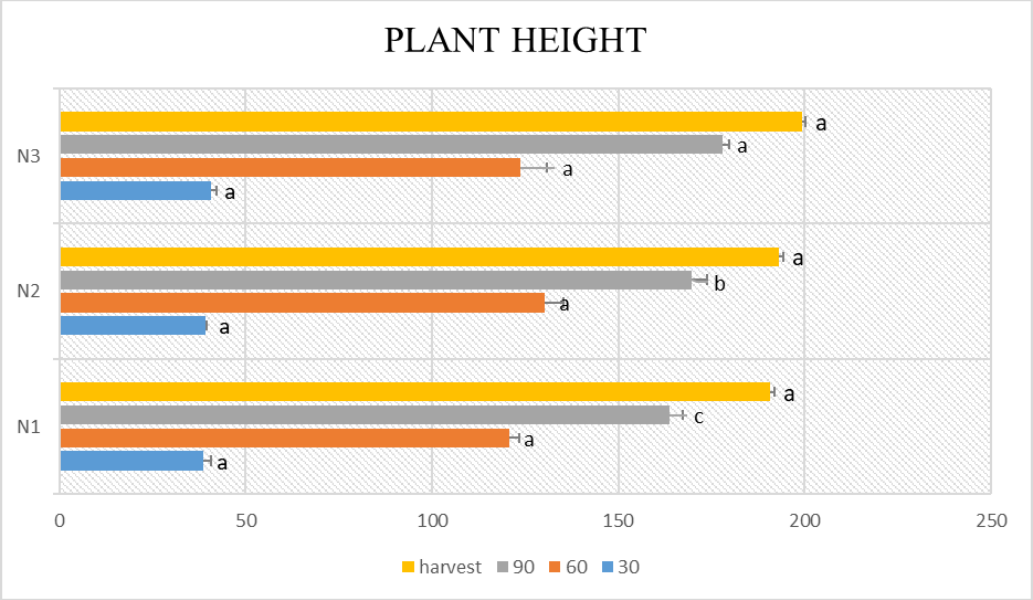
The observations are recorded at 30DAS, 60DAS and 90DAS of spring maize. Plant height, number of leaves, dry weight, shelling percentage, grain yield, test weight and stover yield are calculated. The plant height is recorded with the help of measuring tape, the number of leaves is calculated manually, the dry weight is calculated with the help of a measuring cylinder and the test weight is calculated with the help of a digital microbalance.

RESULTS AND DISCUSSION

EFFECT OF DIFFERENT NITROGEN LEVELS ON SPRING MAIZE

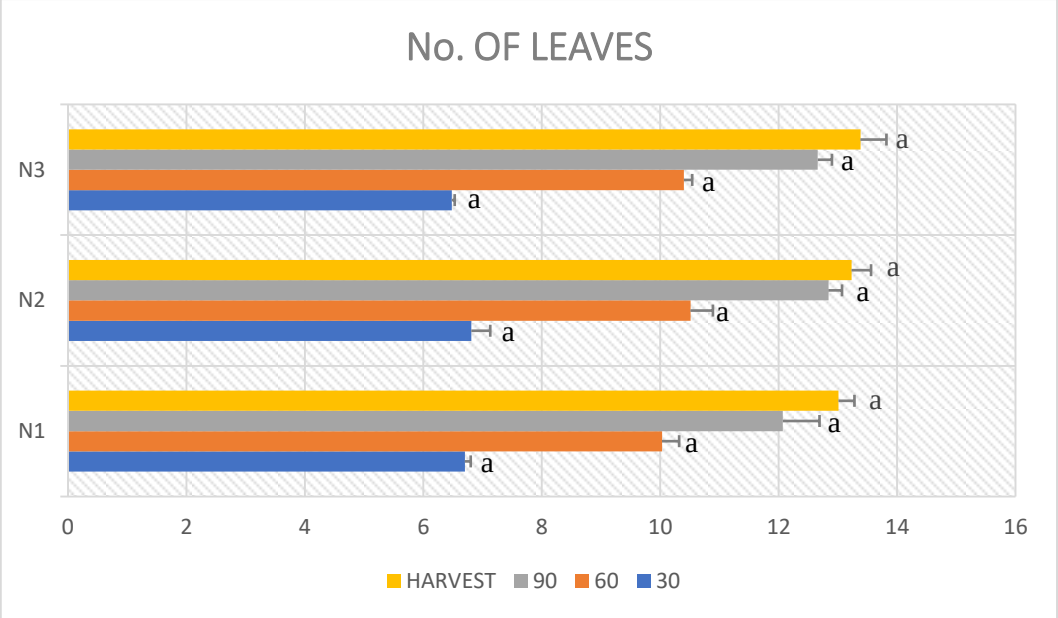
1. **Plant height (cm):** The plant height at different nitrogen levels were observed and the results showed that the maximum plant height was observed in the N3 (160kg/ha) with 40.82cm. After that, it was found in N2 (120kg/ha) with 39.27cm. The least plant height was observed in N1 (80kg/ha) with 38.72cm at 30DAS. At 60DAS, the maximum plant height of 130.37cm was observed in N2 (120kg/ha) and the least plant height was found in N1 (80kg/ha) with 120.91cm. At 90DAS, the maximum plant height was achieved by N3 (160kg/ha) with 178.11cm and the least plant height was achieved by N1 (80kg/ha) with 163.66cm. At the harvest stage, the maximum plant height was achieved by N3 (160kg/ha) with 199.28cm and the least plant height was noticed in N2 (120kg/ha) with 190.82cm shown in graph 1.

Graph 1. EFFECT OF DIFFERENT NITROGEN LEVELS ON THE PLANT HEIGHT OF SPRING MAIZE



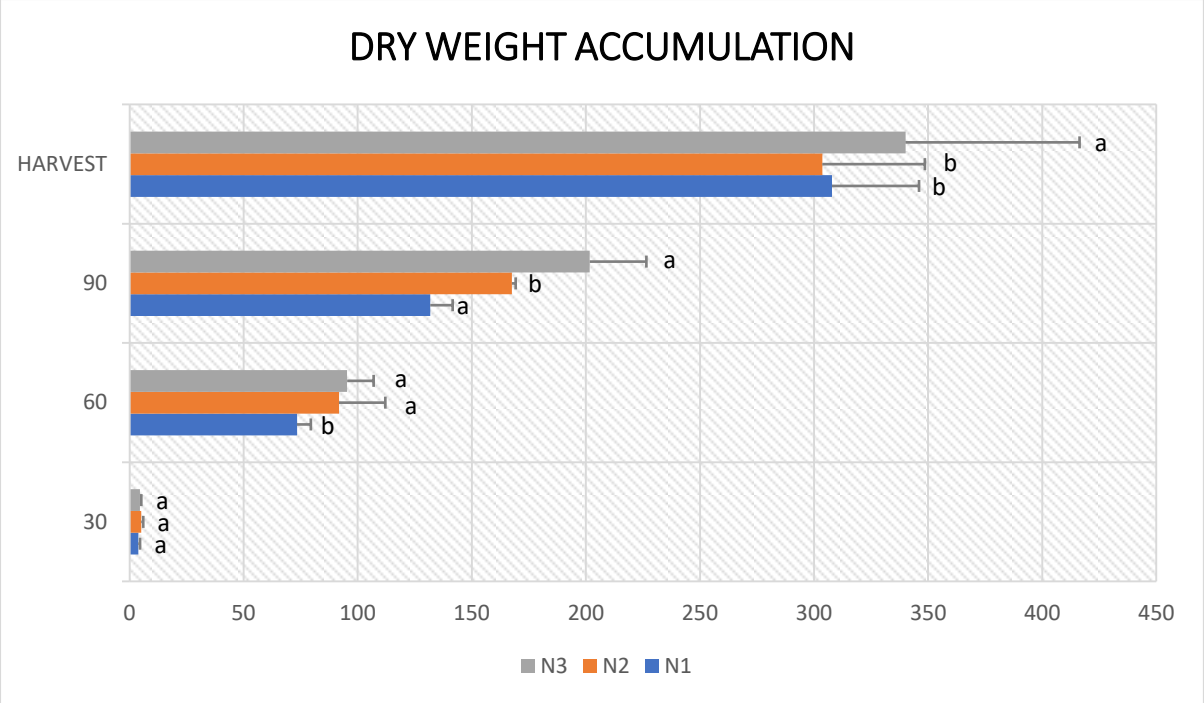
2. **The number of leaves:** The number of leaves at 30DAS was observed, the maximum number of leaves was found in N2 (120kg/ha) with 6.81 and the least number of leaves 6.48 was found in N3 (180kg/ha). At 60 DAS, the maximum number of leaves are observed in N2 (120kg/ha) with 10.51 and the least number of leaves were found in N1 (80kg/ha) with 10.03. At 90DAS, the maximum number of leaves was found in N2 (120kg/ha) with 12.84 and the least number of leaves was obtained in N1 (80kg/ha) with 12.07. At the harvest stage, the maximum number of leaves was found in N3 (160kg/ha) with 13.38 and the least was found in N1(80kg/ha) with 13.01 as an average shown in Graph 2.

Graph 2. EFFECT OF DIFFERENT NITROGEN LEVELS ON THE NUMBER OF LEAVES OF SPRING MAIZE



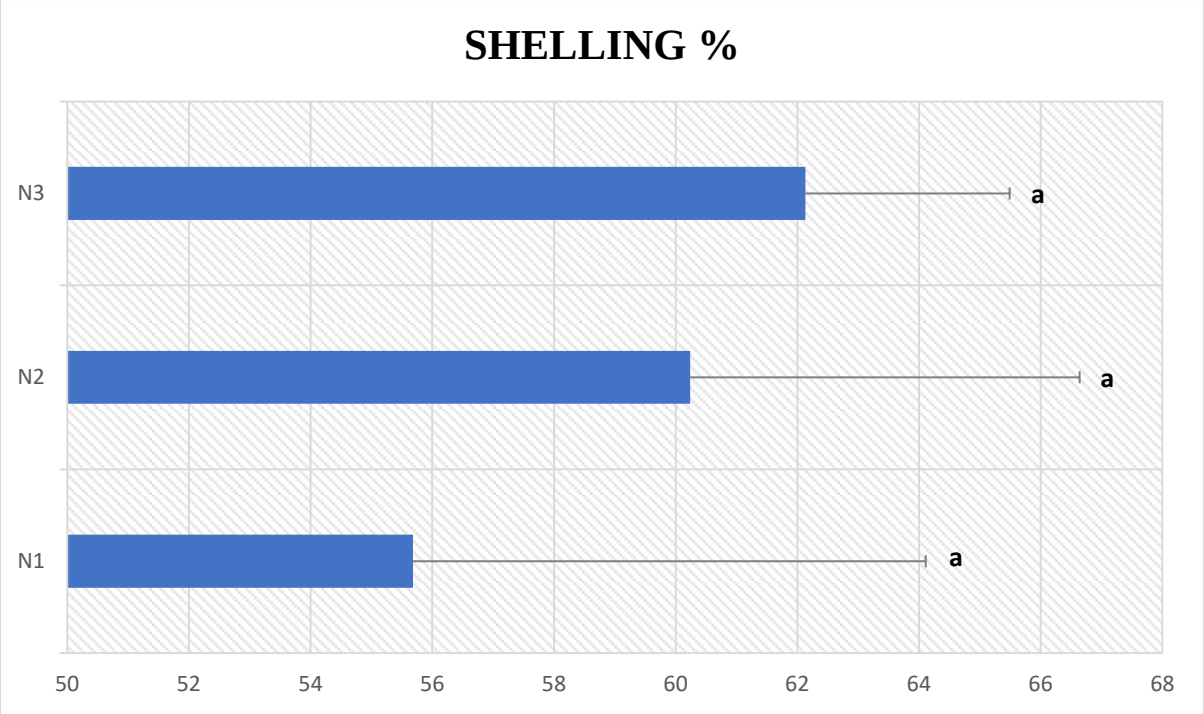
3. **Dry weight (g):** The dry weight accumulation per plant was observed. At 30DAS, the maximum dry weight accumulation was observed in N2 (120kg/ha) with 5.11g and the least was observed in N1 (80kg/ha) with3.88g. At 60DAS, the maximum dry weight was accumulated in N3 (160kg/ha) with 95.36g and the least was observed in N1 (80kg/ha) with 73.35g. At 90DAS, the dry weight was observed maximum at N3 (160kg/ha) with 201.66g and the least was observed at N1 (80kg/ha) with 131.77g. At the harvest stage, the maximum dry weight was noticed in N3 (160kg/ha) with 340.08g and the least dry weight accumulation was observed in N2 (120kg/ha) with 303.61g shown in Graph 3.

Graph 3. EFFECT OF DIFFERENT NITROGEN LEVELS ON THE DRY WEIGHT OF SPRING MAIZE



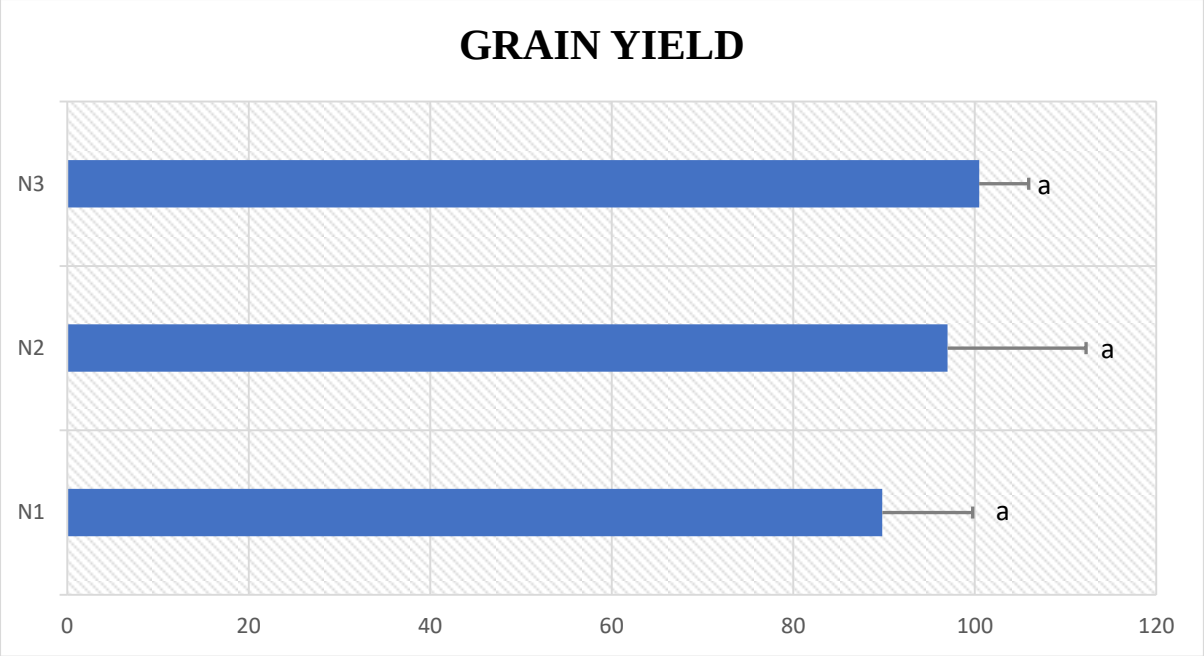
4. **Shelling percentage (%):** The shelling percentage of spring maize was calculated by dividing the grain yield by the cob weight. The maximum number of shelling percentage was found in N3 (160kg/ha) with 62.13% and the least was observed in N1 (80kg/ha) with 55.68% shown in Graph 4.

Graph 4. EFFECT OF DIFFERENT NITROGEN LEVELS ON THE SHELLING PERCENTAGE OF SPRING MAIZE



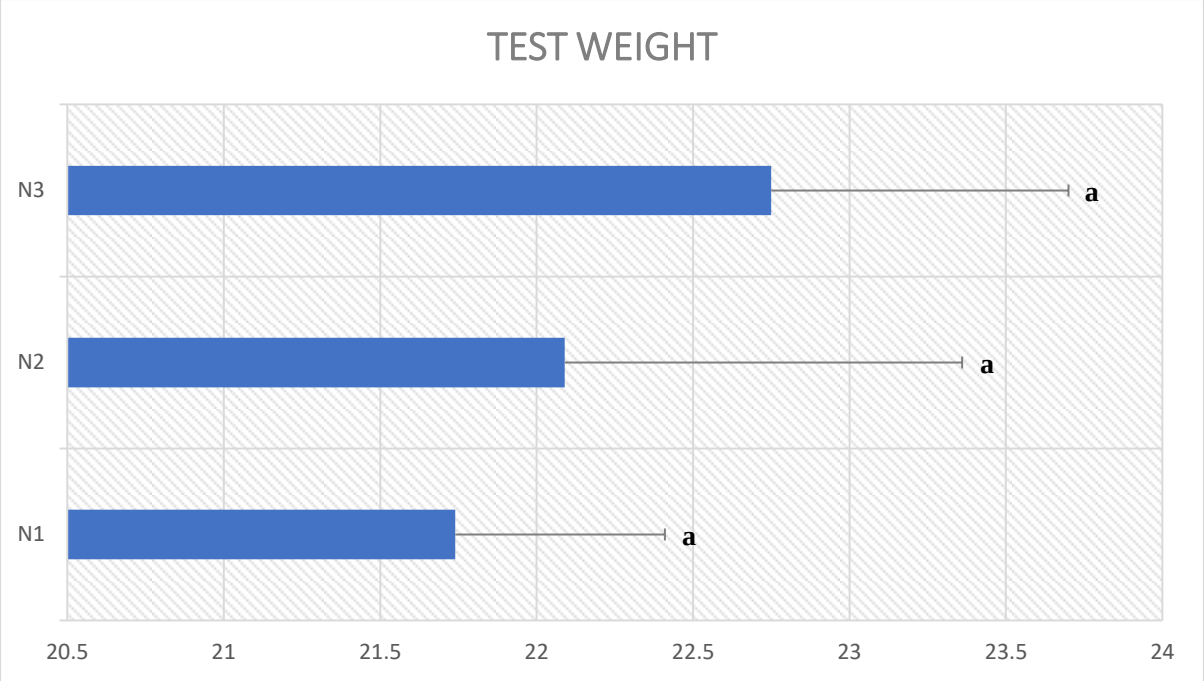
5. **Grain yield (q/ha):** The grain yield was observed maximum at the highest nitrogen level N3 (160kg/ha) with 100.48q/ha and the least were observed at N1 (80kg/ha) with 89.81q/ha shown in graph 5.

Graph 5. EFFECT OF DIFFERENT NITROGEN LEVELS ON THE GRAIN YIELD OF SPRING MAIZE



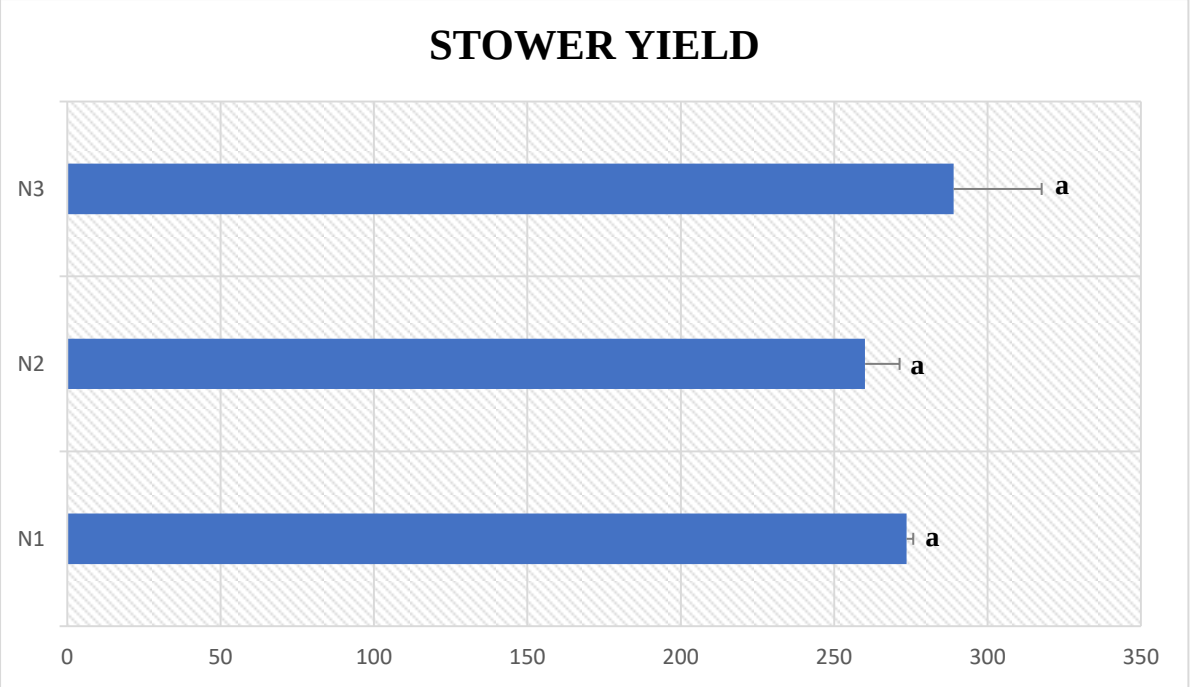
6. **Test weight (g):** The test weight is the weight of 100 seeds and is recorded is the help of a digital weighing balance. The maximum test weight was found in N3 (160kg/ha) with 22.75g and the least was found in N1 (80Kg/ha) with 21.74g shown in Graph 6.

Graph 6. EFFECT OF DIFFERENT NITROGEN LEVELS ON THE TEST WEIGHT OF SPRING MAIZE



7. **Stower yield (q/ha):** The stower yield is calculated in quintal per hectare. The maximum stower yield is observed in N3 (160kg/ha) with 288.95q/ha and the least was observed in N2 (120kg/ha) with 260.11q/ha shown in Graph 7.

Graph 7. EFFECT OF DIFFERENT NITROGEN LEVELS ON THE STOWER YIELD OF SPRING MAIZE



CONCLUSION

From this research "Effect of different nitrogen levels on the growth and yield of spring maize" when three different nitrogen levels N1=80Kg N/ha, N2=120Kg n/ha and N3= 160Kg N/ha are compared with each other. The results show that the maximum grain yield was found in the highest amount of nitrogen applied treatment which is N3=160Kg/ha. This treatment shows the best results as compared to the other nitrogen doses applied. There is an increase in the plant height, number of leaves per plant and dry weight accumulation in plants. Along with this the test weight and yield also increase in this treatment. The shelling percentage, grain yield and stower yield increased in the treatment N3 with 160Kg N/ha. While comparing the three different nitrogen doses in the spring maize crop, the best results are found in the highest nitrogen doses with 160Kg N/ha. After that, good results are found in the moderate nitrogen level with 120Kg N/ha. The least results are found in the lowest nitrogen application with 80Kg N/ha. Hence, from this research trial, we conclude that the treatment with the highest nitrogen level provides the best results and give the highest yield in the spring maize crop.

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