

EFFECT OF DIFFERENT DOSES OF NITROGEN ON ECONOMICAL YIELD AND PHYSIO-CHEMICAL CHARACTERISTICS OF APPLE FRUITS

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ABSTRACT

The experiment was conducted at Horticulture Research Area, Fort Munroo, District D.G. Khan during 2008 with an objective to observe the effects of different doses of nitrogen fertilizer on economical yield and physio-chemical composition of apple (red delicious). The field experiment was laid down in Randomized Complete Block Design having one control, four levels of nitrogen @500, 600, 700, 800 grams per tree and three replications. The parameters under study were comprised of fruit weight (gm), size of fruit (cm), pulp weight (gm), economical yield per tree (kg) along with chemical characteristics of fruits such as pH, acidity (%) and total soluble solids (TSS). The results of the study revealed that fruit yield /tree (kg) have been influenced by application of nitrogen treatment T₅ (800 gm N/ tree) significantly in Fort Munroo region of District D.G. Khan.

Key words: Yield, Nitrogen, Pulp, Fertilizer, Fruit size, D.G. Khan.

INTRODUCTION

Apple (red delicious) is grown extensively in Punjab, Khyber Pakhtunkhwa and Baluchistan due to its economical value and profitable business. The apple is the pomaceous fruit of the apple tree, species *Malus domestica* in the rose family (Rosaceae). It is one of the most widely cultivated tree fruits, and the most widely known of the many members of genus *Malus* that are used by humans. The maximum yield of apple depends upon certain factors, among them nitrogen plays an important role in growth and composition of apple fruit (Marsh *et al.*, 1996). In apple growing areas, the manuring increases the usefulness of the tree and produce quality fruit (Jackson *et al.*, 2003; Engle, 1985). Apart from other various factors responsible for increasing per hectare economical yield, nitrogen plays crucial role in this regard. Red delicious, Kala kulu and Golden delicious apples taken from different marketing locations and retail stores during minimum availability period were analyzed for nutritional and microbial quality (Mukhtar *et al.*, 2010). Twenty one samples were analyzed for proximate composition and 72 samples were examined for surface contaminants using standard techniques. The highest weights of large, medium and small sized apples belonged to Red delicious variety.

Pakistan produced 35,1900 tones of apple during 2007 and its cultivation was limited and restricted to upland areas of Balochistan and northern hilly tracts of the Punjab and Khabar Pukhtonkha. Various varieties of apple which are being grown in Pakistan include Amri, Red delicious, Mashhadi, Kala kulu and Golden delicious. Apple is a highly nutritious fruit containing essential food elements such as carbohydrates, protein,

fat and water (Marlett, 2000; Coart *et al.*, 2006). Apart from its energy value, apple is a good source of soluble and insoluble fiber. The similar results evidenced by Herforth (2000); Adinya *et al.* (2010). The present study was therefore, undertaken to determine the effect of varying levels of nitrogen on the yield and physiochemical characteristics of apple fruit under the agro climatic conditions of Fort Munroo, which is mountainous tract with altitude 7672 meter and has good climate for apple culture. The similar studies were conducted by Qureshi and Chaudhry (1985); William and Billingsley (2006); Baxter and Dillon (1962); Cheng *et al.* (2002).

MATERIALS AND METHODS

The study was undertaken to evaluate the influence of different doses of nitrogen on apple fruit and physiochemical composition, grown in temperate fruit farm Fort Munroo, Horticulture Research Centre, D.G. Khan during 2008. The trees of same cultivar of apple *pyrus malus* (red delicious, locally named Kala Kulu) were fertilized with different doses of nitrogen fertilizers under similar climatic and cultural conditions. There were 15 trees in experiment (including 5 treatments with 3 replications), having R x R distance (10 feet) and P x P distance (12 feet). First half of the nitrogen fertilizer was applied at the time of snow fall on 1st February, 2008. Second half dose was applied three weeks after fruit setting on 1st April, 2008. All cultural practices were applied accordingly. The experiment was conducted in Randomized Complete Block Design containing the composition as one control, four levels of nitrogen per tree @500, 600, 700, 800 grams and three replications.

The fruits were selected from the orchard and fresh samples were brought to Agricultural Chemistry Laboratory, D.G. Khan for studying the physical characteristics and determining chemical composition.

Following methods were employed to record the physical characteristics of fruits as;

Fruit Size (cm): Twenty fruits from each treatment were selected randomly and cortex wedges from a 1 cm thick equatorial slice of each apple was measured for firmness on the sun and shade side using a penetrometer and average fruit size was recorded.

Fruit Diameter (cm): The diameter of each fruit was measured by vernier caliper and average fruit diameter was calculated.

Fruit Weight (gm): The weight of each fruit was determined with an electric balance and the average weight per fruit was calculated.

Fruit Yield (kg): Total number of fruits collected from each treatment was weighed at each picking and the sum was calculated when all the fruits were collected from the treatment. The average fruit yield per plant was calculated.

Pulp and Seed Weight (gm): Fruits were selected randomly at maturity stage, the pulp and seed of these fruits were separated and weighed separately with an electric balance. Average pulp and seed weight were calculated.

Following parameters were employed to record the chemical characteristics of fruits as;

Sensory assessment of fruit (score, 0-10): Fruits evaluated by twenty different people; taste and quality of fruits were evaluated according to the Hedonic test. The score "0" represents the non acceptability while "10" denotes the highly acceptable fruits.

pH of Fruit (blended sample): The blended sample of fruits was prepared from each fruit of same treatment separately and pH was calculated with the help of pH meter and then average pH of all the treatments were calculated in the same manner.

Percent Acidity of fruit (% citric acid): The blended sample of fruits was prepared from each fruit of same treatment separately and percent acidity was calculated.

Total Soluble Solids (⁰Brix): Total soluble solids were determined by using hand refractometer.

Statistically Analysis: The data collected were analyzed statistically by using Fisher's analysis of variance technique according to Steel and Torri (1997), while the means comparison was done by MSTATC computer program.

RESULTS AND DISCUSSION

The data pertaining to the parameters under investigation with regards to physical characteristics such as fruit size, fruit diameter, fruit weight, fruit yield, pulp and seed weight are summarized in Table 1. Standard errors of all means in terms of Treatment T₁ mentioned in Table 1 were computed as 21.305.

Table 1: Physical characteristics of apple by application of different doses of nitrogen fertilizers

Treatments	Fruit size (cm)	Fruit diameter (cm)	Fruit weight (g)	Fruit yield (kg)	Pulp and seed weight (gm)
T ₁	3.20 d	4.00 d	98.90 c	57.14 d	98.90 c
T ₂	4.22 c	4.67 c	61.99 d	63.00 c	62.29 d
T ₃	4.22 c	5.08 b	123.89 b	85.61 b	122.74 b
T ₄	5.06 b	4.79 c	141.36 a	68.20 c	150.75 a
T ₅	6.00 a	6.82 a	150.75 a	91.69 a	141.36 a
LSD	0.29	0.352	11.939	3.039	14.37

Means followed by same letter(s) do not differ significantly at 0.01 probability level.

Table 1 revealed that highest fruit size was noted in T₅ and T₄ which attained the maximum fruit size of 6.00cm and 5.06cm respectively. The treatments T₃ and T₂ were found statistically the same but significantly different from other treatments. T₁ produced minimum fruit size (3.20cm). The data revealed that for obtaining maximum size of the fruit, higher doses of nitrogen were applied in order to increase the size of the fruits considerably. The similar results had been produced by Ahmad *et al.* (1988); Vishanska *et al.* (1980); Dong *et al.* (2001).

As far as the fruit diameter is concerned, which revealed the maximum fruit diameter of 6.82cm and 5.08cm in respect of treatments T₅ and T₃ respectively. The treatments T₄ and T₂ were almost found statistically the same, but non-significantly different from other treatments. T₁ has produced minimum fruit diameter (4.00cm). Hence, the study arrived at conclusion that for obtaining maximum diameter of the fruit, higher doses of nitrogen were required for the substantial increase of the fruit's diameter.

In case of fruit weight, the treatments T₅ and T₄ produced the maximum fruit weight of 150.75gm and 141.36gm respectively. The treatment T₃ was found significantly different from other treatments while Treatment T₂ produced minimum fruit weight (61.99). From the results, it can be concluded that higher doses of nitrogen significantly enhanced fruit weight. The similar results were recorded by Ahmad *et al.* (2002) that fruit weight was increased by the application of nitrogen.

The treatments T₅ and T₃ had achieved the maximum fruit yield of 91.69 and 85.61kg/tree respectively. Treatment T₁ produced minimum fruit yield (57.14kg/tree). Results showed that for obtaining economical yield of the fruit, higher doses of nitrogen

were used for the promotion of fruit's yield. Similarly Williams and Billingsbey (2006) reported that fruit yield increased by 93 kg/tree when apple tree were fertilized with 500 gm nitrogen fertilizer.

In fruit pulp and seed weight, the treatments T₄ and T₅ evidenced the maximum fruit pulp weight of 150.75gm and 141.36 gm respectively. Treatment T₂ produced minimum fruit weight (62.29gm). The results provided that higher doses of nitrogen had increased the pulp weight of the fruits. The results are in line with past studies referred by Cheng *et al.* (2002); Jackson *et al.* (2003) and Bogan *et al.* (2004); Joes *et al.* (1970) that pulp weight was increased significantly by the application of 400gm nitrogen per tree.

Table 2: Chemical characteristics of apple by application of different doses of nitrogen fertilizers

Treatments	Sensory Assessment of Fruit (score, 0-10)	pH of Fruit (blended sample)	Percent Acidity of Fruit (% citric acid)	Total Soluble Solids (°Brix)
T ₁	3.20	3.85	5.03	11.89
T ₂	4.22	3.81	3.51	12.21
T ₃	4.22	3.83	4.72	11.07
T ₄	5.06	3.83	4.82	11.16
T ₅	6.00	3.97	4.18	10.57
LSD	N.S	N.S	N.S	N.S

NS= Non-significant.

Table 2 indicates sensory assessment, pH, acidity and TSS. Sensory assessment of fruit scores showed non-significant differences among the treatments. Such results were concluded that higher doses of nitrogen did increase the quality of the fruits. The similar results were recorded by Cheng *et al.* (2002). While the pH of Fruit indicated that treatment T₅ attained the maximum fruit pH of 3.97. The treatment T₃ and T₄ were found statistically the same but not significantly different from other treatments. T₂ produced minimum single fruit pH (3.81). The results showed that higher dose of nitrogen did not enhance the pH of the fruits. The similar results were shown by Guak *et al.* (2001) whom reported significantly less N to be withdrawn from leaves compared with those plants undergoing natural defoliation within 6 d of nitrogen application. Fruit acidity indicated that treatment T₁ has attained the maximum fruit percent acidity (5.03%), while T₂ produced minimum fruit percent Acidity of (3.51%). Total Soluble Solids show that treatments T₂ attained the maximum fruit Total Soluble Solids of 12.21%. The treatment T₅ was found minimum (10.57%). These findings are in close agreement with the results reported by Ding *et al.* (2000); Lee *et al.* (2003).

Conclusion: In this experiment the study was planned to observe the effect of different doses of Nitrogen fertilizer on apple fruit yield and quality parameters. It was found that the most suitable dose of Nitrogen fertilizer is

treatment T₅ (800gm/tree), which produced maximum fruit size, fruit diameter, fruit weight, yield/tree, pulp weight as compared to other treatments. Hence, it is concluded that treatment T₅ is the most appropriate dose of nitrogen to obtain economical yield and of better quality apple for this region.

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