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EFFECT OF NUTRIENT ON PHYSICO-CHEMICAL CHARACTERISTICS OF PHALSA (*GREWIA SUBINAEQUALIS* D.C.) FRUITS

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ABSTRACT
Phalsa (*Grewia subinaequalis* D.C.) which is also known as star apple is a subtropical fruit of India. It is good crop for arid and semi arid regions because of hardy nature and capacity to tolerate high temperature. It bears small berry like fruits of deep redish brown colour in cluster in axil of leaves of the young shoots. Ripe fruits are subacidic and good source of vitamin A and C, and also fair source of phosphorus and iron. The fruits are used for making excellent juice and squash. The experiment was laid out during January to October 2003 at Main Experiment Station in Factorial Randomized Block Design having seven treatments including three levels of nitrogen (50, 75, 100 g plant-1), two levels of potash (25, 50g plant-1) and absolute control with three replication. The observation recorded on physico-chemical parameter. The significant higher TSS/acid ratio and Ascorbic acid was recorded with 75g N plant-1 and 50g K plant-1 whereas, significant higher sugars was with 100g N plant-1 and 50g K plant-1, weight of fruits increased significantly up to 75g N plant-1 and 25g K plant-1 whereas, . Acidity decrease and juice per cent increase significantly up to 50g N plant-1 and 25g K plant-1. Finally it may be concluded that for better physic-chemical parameter phalsa should be fertilized with 75g N plant-1 and 50g K plant-1.

KEYWORDS: Nutrients, physicho-chemical, phalsa.

INTRODUCTION

Phalsa (*Grewia subinaequalis* D.C.) which is also known as star apple is a subtropical fruit of India. It belongs to the family "Tiliaceae". This family has about 41 genera and 400 species which are mostly distributed in the tropical and subtropical region of the world. In India, it is commercially grown in Punjab, Haryana, Rajsthan, Uttar Pradesh and Madhya Pradesh. Besides these states, it is also cultivated on limited scale in the states of Maharashtra, Gujarat, Andhra Pradesh, Bihar and West Bengal. Phalsa is good crop for arid and semi arid regions because of its hardy nature and capacity to tolerate high temperature. It bears small berry like fruits of deep redish brown colour. This subtropical fruit flowers in February and the fruits ripen in second fortnight of April and continues up to middle of June. Phalsa is deciduous in habit in northern India and sheds its leaves during winter season which makes it capable of withstanding the frost. Phalsa produces fruits in cluster in axil of leaves of the young shoots. It is one of the hardiest fruit crop with regard to the attack of insect-pests and diseases. Ripe fruits are subacidic and good source of vitamin A and C. They are also fair source of phosphorus and iron. Fruit contains 50-60 per cent juice, 10-11 per cent sugar and 2-2.5 per cent acid. The fruits are used for making excellent juice and squash. It is also used as table fruit by children. The fruit possess high medicinal properties. Its riped fruits exert cooling effect. In Unani medicine it is considered to be beneficial for heart, diarrhoea and fever. Phalsa has great utility and its own importance and usefulness but its area under cultivation is restricted and confined to only small scale in a particular area. It is grown as minor fruit in the country. The main problem in the phalsa cultivation is the uneven ripening and small berries which are to be picked individually. So the cost of harvesting is too high which became a major constraint, to phalsa growers. A large number of factors influence the growth, yield and quality of phalsa. Although effect of individual factors may differ from place to place but optimum supply of mineral nutrients throughout the years is the most important which helps to maintain healthy condition of tree. They play an important role in growth and development of plant *etc*.

METHODS & MATERIALS

The experiment was carried out under sodic soil condition. The experimental site is located at the N.D.U.A. & T., Kumarganj, Faizabad on the Raibareilly Road at the distance of 42 km away from Faizabad district headquarter. Geographically, it is situated at 26.470N latitude, 82.120E longitude and altitude of 113 meter from mean sea level. The site is located in typical saline-alkali belt of indogangetic plains of Eastern Uttar Pradesh The doses of N and K is N 50g, N 75g, and N 100 g per plant, K 25 g, K 50 g per plant and control N 0, K0 g. Ten year old forty two plants of phalsa cv. local grown under uniform cultural practices were taken as experimental material. Pruning was done at 50 cm height from the ground level in the 1st week of January. A basal common dose at the rate of 10 kg plant^{-1}, farm yard manure, 50, 75 and 100 g plant^{-1} nitrogen and 25, 50 g plant^{-1} potash were applied in the experimental field, alongwith a fixed dose

of phosphorus at the rate of 50 g plant^{-1}. The manures and fertilizers were applied in 40 cm wide rings dug 15 cm away from the plant trunk and were mixed in to the soil. Half dose of nitrogen and full dose of FYM, phosphorus and potassium was applied in the second week of February to encourage growth as well as flowering and the rest of nitrogen dose was added in April for fruit set and subsequent development. Single guard row was provided around each plot and double unit of plant was selected for fertilization in each treatment. Fruit weight, juice percentage, TSS, acidity, ascorbic acid and sugar. The experiment was laid out in factorial RBD with three replications. The data were analysed at 5% level was used for finding the significant difference among the treatments.

RESULTS & DISCUSSION

Observation recorded during the present investigation showed that average weight of 100 fruit (Table 1) increased significantly with the application of nitrogen and potash. It might be attributed to more efficient uptake of these elements because of efficient absorption and consequently more luxuriant vegetative growth in the initial stage which later on resulted in more matabolites for developing fruits. These results are in accordance with the earlier findings of Sadhu *et al*. (1975) in phalsa Ghosh and Mitra (1990) in litchi, Ghosh and Das (1999) in acid lime and Sidhu *et al*. (2002) in grape.

Fertilizer application increased juice percentage (Table 1) significantly over control but further increase in each nutrient did not show significant response. Juice percentage increased due to fact that fertilizer application result in more uptake of nutrient due to which concentration of nutrients increase in plant cell and plant absorb more water along with minerals because of increase turger pressure resulting in increased juice percentage. The results obtained by Ghosh and Das (1999) in acid lime and Prasad and Mali (2000) in pomegranate, are in agreement with the present findings.

TABLE 1: Weight of 100 fruits and Juice percentage is affected by nitrogen and potash levels

Treatment	Weight of 100 fruits (g)	Juice (%)
Nitrogen levels (g plant^{-1})		
50 (N_1)	54.17	43.67
75 (N_2)	58.01	44.34
100 (N_3)	60.72	44.94
SEm ±	1.21	0.96
CD (P = 0.05)	3.73	NS
Potash levels (g plant^{-1})		
25 (K_1)	56.76	43.95
50 (K_2)	58.50	44.68
SEm ±	0.99	0.78
CD (P = 0.05)	NS	NS
Control (N_0K_0)	47.12	39.67
SEm ±	1.71	1.35
CD (P = 0.05)	5.28	4.17

An appreciable increase in total soluble solids content (Table 2) was noted with the application of nitrogen and potash. These increases in T.S.S. content of fruit may be due to both nutrients are helpful in photosynthesis which ultimately led to the accumulation of carbohydrates which helps in increase of T.S.S. content of the fruit.

TABLE 2: Total soluble solids (TSS), acidity and TSS/acid ratio as influenced by nitrogen and potash level

Treatment	Total soluble solids (^{0}Brix)	Acidity (%)	TSS/acid ratio
Nitrogen levels (g plant^{-1})			
50 (N_1)	25.63	2.69	9.53
75 (N_2)	27.48	2.64	10.43
100 (N_3)	28.33	2.60	10.89
SEm ±	0.57	0.06	0.21
CD (P = 0.05)	1.76	NS	0.65
Potash levels (g plant^{-1})			
25 (K_1)	26.36	2.66	9.93
50 (K_2)	27.93	2.63	10.63
SEm ±	0.47	0.05	0.17
CD (P = 0.05)	1.43	NS	0.53
Control (N_0K_0)	22.80	2.88	7.91
SEm ±	0.81	0.09	0.30
CD (P = 0.05)	2.48	0.26	0.92

Similar results have also been reported by Ram and Prasad (1988) in banana, Shyamal and Mishra (1989) in mango, Ghosh and Mitra (1990) in litchi and Walling and Sanyal (1995) in guava. Acidity of phalsa juice (Table 2) decreased significantly with the fertilizer application. The reason for decrease in acidity due to fertilizer application might be ascribed to increase translocation of carbohydrate and increase metabolism due to conversion of acids to sugar. These results are in agreement with the earlier findings of Shyamal and Mishra (1989) in mango, Bhatia *et al*. (2001) in guava, Lal and Sen (2001) in guava and Sidhu *et al*. (2002) in grape. There was significant increase

in TSS/acid ratio (Table 2) with the application of nitrogen and potash and increase in their doses have further improved the TSS/acid ratio. The possible reason for above trend might be due to increase in T.S.S. and decrease in acidity. These results are in accordance with those observed by Gosh and Das (1999) in acid lime, Lal and Sen (2001) in guava and Satapathy and Banik (2002) in mango. The results in respect of ascorbic acid content (Table 3) of fruit juice indicate that it increased significantly with the application of N and K over control. Application of nitrogen and potash increased ascorbic acid content of fruit juice due to increase in synthesis of catalytic activity of several enzymes and Co-enzymes which are instrumental in ascorbic acid synthesis. These results also confirm the earlier findings of Shyamal and Mishra (1989) in mango, Ghosh and Mitra (1990) in litchi and Walling and Sanyal (1995) guava.

TABLE 3: Ascorbic acid as affected by nitrogen and potash levels

Treatment	Ascorbic acid (mg/100 ml juice)
Nitrogen levels (g plant^{-1})	
50 (N_1)	32.80
75 (N_2)	35.67
100 (N_3)	36.70
SEm ±	0.73
CD (P = 0.05)	2.26
Potash levels (g plant^{-1})	
25 (K_1)	34.01
50 (K_2)	36.10
SEm ±	0.60
CD (P = 0.05)	1.84
Control (N_0K_0)	28.57
SEm ±	1.04
CD (P = 0.05)	3.19

The reducing, non-reducing and total sugar content (Table 4) in phalsa fruits increased significantly with the increasing levels of nitrogen and potash.

TABLE 4: Reducing sugar, Non reducing sugar and Total sugar is influenced by nitrogen and potash level

Treatment	Reducing sugar (%)	Non reducing sugar	Total sugar (%)
Nitrogen levels (g plant^{-1})			
50 (N_1)	16.56	1.86	18.42
75 (N_2)	18.59	2.08	20.67
100 (N_3)	19.84	2.22	22.06
SEm ±	0.37	0.04	0.42
CD (P = 0.05)	1.15	0.13	1.28
Potash levels (g plant^{-1})			
25 (K_1)	17.53	1.96	19.49
50 (K_2)	19.13	2.14	21.27
SEm ±	0.31	0.03	0.34
CD (P = 0.05)	0.94	0.11	1.05
Control (N_0K_0)	14.16	1.59	15.75
SEm ±	0.53	0.06	0.59
CD (P = 0.05)	1.63	0.18	1.81

This significant increase in sugar content might be due to more accumulation of carbohydrates in fruits as a result of increased supply of N and K. similar results were also obtained by Ram and Prasad (1988) in banana, Shyamal and Mishra (1989) in mango, Ghosh and Mitra (1990) in litchi and Banik *et al*. (1997) in mango.

CONCLUSION

The Juice percentage increased and acidity decreased significantly with 50g N plant^{-1} and 25g K plant-^{1} over control. The Total soluble solids (TSS), TSS/acid ratio and ascorbic acid increased significantly with 75g N plant^{-1} and 50g K plant^{-} The reducing, non-reducing sugar and total sugar increased significantly with 100 g N plant^{-1} and 50g K plant^{-1}.On the basis of the above results obtained in the present investigation, it can be concluded that for securing better quality fruit, phalsa crop should be fertilized with 75g N and 50g K plant^{-1}.

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