GLOBAL JOURNAL OF BIO-SCIENCE AND BIOTECHNOLOGY

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EFFECT OF NUTRIENT ON VEGETATIVE GROWTH, FRUIT MATURITY AND YIELD ATTRIBUTES OF PHALSA (*Grewia subinaequalis* D.C.)

M. Kumar[1], R. Dwivedi[1], A.K. Anand[1] & A. Kumar[2]
Department of Horticulture, N.D. University of Agriculture and Technology, Narendra Nagar (Kumarganj) Faizabad (U.P)
[1]A.N.D.Nagar Nigam Mahila Mahavidyalaya, Kanpur (U.P)
[2]Babasaheb Bhimrao Ambedkar University, Lucknow-226 025 (U.P)

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 various growth, maturity and yield parameter. The significant higher number of shoot plant-[1], number of fruiting nodes-1, yield plant-1, yield ha-1, was recorded with 75g N plant-1 and 50g K plant-1. The length of shoot and number of leaves shoot-1, fruit set and days taken to fruit maturity increased significantly up to 75g N plant-1 and 25g K plant-1 whereas, fruit drop was lower at 75g N plant-1 and 25g K plant-1. Finally it may be concluded that for better growth, fruit maturity and maximum fruit yield phalsa should be fertilized with 75g N plant-1 and 50g K plant-1.

KEYWORDS: Nutrients, Vegetative growth, maturity, yield, 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. It's 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. The scientific information regarding nutritional requirement of phalsa under sodic soil condition are very meagre. With the application of nitrogen, phosphorus and potash some improvement in growth and yield was reported by Singh and Gaur (1989).

MATERIALS & METHODS

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. The number of shoots per plant, length of shoot, number of leaves per shoot, number of fruiting nodes per shoot, fruit set, fruit drop, fruit maturity and yield per plant were recorded. The experiment was laid out in factorial RBD with three replication. The data were analysed at 5% level was used for finding the significant difference among the treatments.

RESULT & DISCUSSION

The number of shoots was significantly increased with the application of N and K and increases in their levels have further increased the number of shoots, whereas interactions were non significant (Table-1). The reason for increase in number of shoots plant-1 might be due to the fact that nitrogen is a constituent of protein which is essential for formation of protoplasm and thus, affecting the cell division and cell enlargement which potash enhances the concentration of nucleoprotein in leaves and all these factors may be contributed to all multiplication which ultimately resulted in to emergence of more new shoots. These findings are in conformity with Sadhu *et al.* (1975) and Singh and Gaur (1989) in phalsa. The significant increase in plant heigh might be due to the fact that nitrogen is a essential constituent for the formation of protein and chlorophyll and potash help in formation of both thus affecting the cell decision and cell enlargement and ultimately better plant height. Similar results were also obtained by Sadhu *et al.* (1975) in phalsa, Habeeb and Shafeek (1976) in pear, Shyamal and Mishra (1989) in mango, Singh and Gaur (1989) in phalsa, Sharma *et al.* (1990) in litchi and Selamat *et al.* (1993) in custard apple. The number of leaves shoot-1 (Table 1) were significantly increased with the application of fertilizer over control and further increase in nitrogen level also increased number of leaves shoot-1 significantly might be due to the effect of abundant supply of N and K on plant growth. Moreover, the increase in vegetative growth, may be attributed to an increase uptake of these elements which being a constituent of protein component of protoplasm, favourably affected chlorophyll contents in leaves. All these factors contributed to cell multiplication, which has resulted into photo synthesis and its translocation, to promote better vegetative growth. Thus, increased number of leaves shoot-1 with high doses of N and K were obtained. These findings are in consonance with Sadhu *et al.* (1975) in phalsa, Shyamal and Mishra (1989) in mango, Singh and Gaur (1989) in phalsa and Parida *et al.* (1994) in banana.

TABLE 1: Number of shoots, length of shoot and number of leaves as affected by nitrogen and potash levels

Treatment	Number of shoots plant^{-1}	Length of shoot (m)	Number of leaves shoot^{-1}
Nitrogen levels (g plant^{-1})			
50 (N_1)	102.59	1.85	58.45
75 (N_2)	113.17	2.04	62.69
100 (N_3)	118	2.08	65.47
SEm $\pm$	2.31	0.05	1.30
CD (P = 0.05)	7.12	0.15	4.01
Potash levels (g plant^{-1})			
25 (K_1)	107.89	1.95	60.88
50 (K_2)	114.61	2.02	63.52
SEm $\pm$	1.89	0.04	1.06
CD (P = 0.05)	5.81	NS	NS
Control (N_0K_0)	87.53	1.57	50.1
SEm $\pm$	3.27	0.07	1.84
CD (P = 0.05)	10.06	0.21	5.68

Number of fruiting nodes shoot^{-1} (Table 2) increased significantly with the fertilizer application and further increase in their doses also show significant response. However, interaction effect was non-significant. The reason for increase in number of fruiting nodes is due to higher level of N and K in the soil increased synthesis of amino acids and better carbohydrate transformation which in turn resulted in to better growth and better length of shoot which has ultimately produced more fruiting nodes shoot^{-1}. These results confirm the earlier findings of Kohli *et al*. (1981), Baghel *et al*. (1987), Nair *et al*. (1990) and Singh and Kashyap (1992) in banana.

TABLE 2: Number of fruiting nodes as affected by nitrogen and potash levels

Treatment	Number of fruiting nodes shoot^{-1}
Nitrogen levels (g plant^{-1})	
50 (N_1)	15.02
75 (N_2)	16.18
100 (N_3)	16.7
SEm ±	0.37
CD (P = 0.05)	1.15
Potash levels (g plant^{-1})	
25 (K_1)	15.40
50 (K_2)	16.53
SEm ±	0.31
CD (P = 0.05)	0.94
Control (N_0K_0)	11.77
SEm ±	0.53
CD (P = 0.05)	1.63

TABLE 3: Fruit set and fruit drop percentage as affected by nitrogen and potash levels

Treatment	Fruit set (%)	Fruit drop (%)
Nitrogen levels (g plant^{-1})		
50 (N_1)	52.43	7.85 (2.89)
75 (N_2)	56.10	6.57 (2.66)
100 (N_3)	57.46	6.15 (2.58)
SEm ±	1.17	0.07
CD (P = 0.05)	3.59	0.20
Potash levels (g plant^{-1})		
25 (K_1)	54.25	7.06 (2.75
50 (K_2)	56.40	6.62 (2.67)
SEm ±	0.95	0.05
CD (P = 0.05)	NS	NS
Control (N_0K_0)	46.34	11.27 (3.43)
SEm ±	1.65	0.09
CD (P = 0.05)	5.08	0.28

It has been observed that fruit set per cent (Table 3) increased significantly with the application of nutrients. The possible reason for the above trend might be due to the fact that nitrogen is component of chlorophyll and potash help in chlorophyll formation that regulate the build up of proper C:N ratio, which control the flowering and fruiting of plant. These results also confirm the earlier findings of Shyamal and Mishra (1989) in mango, Mandal *et al.* (1993) in custard apple and Joolka and Sharma (2000) in almond. In phalsa trees fruit drop (Table 5) was significantly reduced with the application of fertilizer than the control. Further individual elements have shown response in controlling fruit drop. Similar results were also obtained by Shyamal and Mishra (1989) in mango and Mandal *et al*. (1993) in custard apple.

The days required the fruit maturity (Table 4) increased significantly with the application of fertilizer over control. Further nitrogen application also increased days taken to fruit maturity where as interaction effect was failed to increase days required for fruit maturity significantly. Days taken to fruit maturity increase due to fact that fertilizer increase, fruit size which may increase day required for fruit maturity.

TABLE 4: Days taken to fruit maturity as affected by nitrogen and potash levels

Treatment	Days taken to fruit maturity
Nitrogen levels (g plant^{-1})	
50 (N_1)	53.59
75 (N_2)	57.34
100 (N_3)	57.92
SEm ±	1.20
CD (P = 0.05)	3.71
Potash levels (g plant^{-1})	
25 (K_1)	55.50
50 (K_2)	57.06
SEm ±	0.98
CD (P = 0.05)	NS
Control (N_0K_0)	49.33
SEm ±	1.30
CD (P = 0.05)	5.24

Values given in parenthesis are transformed.

The yield of fruits was recorded plant^{-1} and ha^{-1} (Table 5). The yield of fruits has increased significantly with the application of the fertilizer and increase in their doses has further increases the yield significantly. However, interaction between nitrogen and potash did not influence the yield significantly. The increase in yield plant^{-1} and hectare^{-1} is due to increase in number of shoot plant^{-1}, number of fruiting nodes shoot^{-1}, fruit set percentage and weight of fruit and due to decrease in fruit drop. There are considerable evidence in support of these result such as Mustaffa (1988) in banana, Chakrabarty and Majumdar (1989) in pineapple, Reddy and Kohli (1989) in papaya Singh and Gaur (1989) in phalsa and Bhoora *et al*. (2002) in sapota.

TABLE 5: Yield as affected by nitrogen and potash levels

Treatment	Yield plant^{-1}	Yield ha^{-1} (q)
Nitrogen levels (g plant^{-1})		
50 (N_1)	3.681	61.34
75 (N_2)	4.029	67.14
100 (N_3)	4.162	69.36
SEm ±	0.091	1.52
CD (P = 0.05)	0.281	4.68
Potash levels (g plant^{-1})		
25 (K_1)	3.839	63.99
50 (K_2)	4.075	67.91
SEm ±	0.074	1.24
CD (P = 0.05)	0.229	3.82
Control (N_0K_0)	2.912	48.53
SEm ±	0.129	2.15
CD (P = 0.05)	0.397	6.62

CONCLUSION

The application of 75g N plant^{-1} and 50g K plant^{-1} increased number of shoot plant^{-1} and yield significantly. The use 75g N plant^{-1} and 25g K plant^{-1} increased plant height and number of leaves significantly. Fruit set percentage increased and fruit drop percentage decreased significantly with 75g N plant^{-1} and 25g K plant^{-1}. The Days taken to fruit maturity and weight of fruit increased significantly with 75g N plant^{-1} and 25g K plant^{-1}.

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