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The Effect of Soil Application of NPK on the Fruitfulness of Buds in the Anab-E-Shahi Grape Variety

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N, P, K fertilizers were applied to Anab-e-Shahi vines, separately and in combination about two weeks prior to fruitbud initiation. The buds were collected after the harvest of the crop and observed microscopically for fruitfulness. The nutrients, K in the basal region and P in the distal region of the cane had increased the fruitfulness of buds significantly. Higher percentage of fruitfulness was observed in the nodes 8, 9 and 10 as against the usual positions 3-5 nodes in the locality. The length to width ratio of the cluster primordia was inversely proportional to the number of fruitful buds in a cane.

The degree or extent of initiation of buds into fruitful ones or otherwise is directly related to the ultimate yield (Barnard and Thomas, 1933). In a given grape variety, fruit bud initiation is governed mainly by cultural, climatic and nutritive factors, and the latter are often the most important (Antcliff and Webster, 1955; Alleweldt, 1964).

Anab-e-shahi, the popular table grape variety of Southern India is noted for its alternate or irregular cropping trend. This is attributed to the failure of fruit bud initiation due to weakening of the vine from overcropping. A unique feature of the Madras region of South India is the production of two crops per year. It is possible that the vines are exhausted of stored metabolites as a result of overcropping and that this in turn would cause failure of fruit bud initiation resulting in irregular bearing.

Fruit bud initiation has been reported to occur from 45 to 77 days after pruning under the conditions of Central districts of Tamil Nadu. Subsequent studies at Coimbatore revealed that application of phosphate enhanced the fruitfulness in this variety (Nanaya, 1966). Therefore, an investigation was initiated to determine whether nutrients added to the soil would increase the available nutrients in the plant prior to fruit bud initiation and thus, enhance fruitfulness.

MATERIALS AND METHODS

Twenty four uniform, arbor-trained bearing vines of *Vitis vinifera* var. Anab-e-shahi served as the experimental material in a vineyard which was alkaline, relatively high in P, but low in N content. The vines were routinely manured at each of the two times of pruning made per year once in May and again in December. One

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hundred kg of cattle manure or compost plus 5 kg of 10:5:5 N, P, K mixture was applied. This is hereafter referred to as the basal application. The vines were pruned to seven-bud spurs in December 1965. The pruning level was based on the prediction technique of Antcliff and Webster (1955).

N, P, K nutrients were applied as urea, super phosphate and muriate of potash respectively in addition to the basal application at 430 g N, 540 g P_2O_5 and 1740 g K_2O per vine, 35 days after pruning. The nutrients were applied alone and in combinations as referred in Table II. Single vines per treatment replicated three times were used. The vines with the basal application of organic manure and fertilizer mixture alone were used as the control.

The buds were sampled 120 days after pruning in April-May 1966. Ten buds per node from the third to the 20th node from the base of the shoot were collected for microscopic examinations. The buds were fixed in 5:5:50 solution of formalin, acetic acid and 50% ethanol. The buds were observed with a Bausch and Lomb stereo-microscope after removal of bud scales. The buds with cluster primordia were classified as fruitful and others as unfruitful. The percentage of fruitfulness was determined and the results statistically interpreted. The length and width of cluster primordia were measured during bud examination and the length to width ratio was calculated for the fruitful buds from third to 10th node.

RESULTS AND DISCUSSION

The data obtained on fruitfulness of buds in the third to 10th node region of canes as influenced by the nodal position and fertilizer treatments were statistically interpreted. It was found that buds of 9-10 nodes were found to be more fruitful than the other nodes. The basal 7 nodes significantly differed at 1% level from the distal nodes 8 to 10. Among the fertilizer treatments, application of potash (K) significantly increased the fruitfulness of buds. Other nutrients and combinations did not influence the fruitfulness of buds (Table I).

TABLE I. Effect of N, P, K Fertilizers and their Interactions on fruitfulness of buds of Anab-e-Shahi grapes

Treatments	% of fruitfulness (3-10 nodes)	% of fruitfulness (11-20 nodes)
i. Treatment effect :		
N_o	1.20[a]	1.90[a]
N_1	1.26[a]	1.66[b]
P_o	1.20[a]	1.56[a]
P_1	1.25[a]	2.04[b]
K_o	1.09[a]	1.99[a]
K_1	2.45[b]	1.61[b]
ii. Interaction effect :		
$N_o P_o$	1.19[a]	2.28[a]
$N_1 P_o$	1.20[a]	1.80[a]
$P_1 N_o$	1.19[a]	1.54[a]
$N_1 P_1$	1.33[a]	1.54[a]
$N_o K_o$	1.04[a]	2.16[a]
$K_1 N_o$	1.29[a]	1.73[a]
$N_1 K_o$	1.10[a]	1.83[a]
$N_1 K_1$	1.41[a]	1.26[a]
$P_o K_o$	1.15[a]	2.00[a]
K_1	1.36[a]	2.07[a]
P_1	1.15[a]	2.00[a]
$P_1 K_1$	1.36[a]	1.15[b]

i. Nos. with different superscripts differ significantly from each other at 5% level.
ii. Subscript 'o' means exclusion of the nutrient and '1' means inclusion of the nutrient.

When the fruitfulness as influenced by N, P, K fertilizers was related to the length/width ratio of cluster primordia a clear relationship between the fruitfulness and length/width ratio was indicated (Table II).

TABLE II. Effect of N, P, K fertilizers on fruitfulness of buds on length to width (L/W) Ratio of cluster primordia in 3-10 nodes

Fertilizer treatments			No. of fruitful buds out of 80 buds	Length to width ratio of cluster primordia
N	P	K		
in g	in g	in g		
0	0	0	7	1.6
430	0	0	5	2.1
0	540	0	7	2.0
0	0	1740	19	1.8
430	540	0	14	1.8
430	0	1740	23	1.6
0	540	1740	17	1.4
430	540	1740	28	1.7

As certain amount of bud variability was observed towards the distal end of the cane, the influence of treatment on fruitfulness of buds ranging from 11th to 20th node was examined. The analysis of variance of the data showed significant differences as a result of applications of P, K, NP, PK and NPK combinations. Phosphorous caused a significant increase in fruitfulness. The K itself had no negative influence, but in combination with P a negative influence was observed (Table I).

The vines undergo heavy stress for nutrients or stored food during the fruit bud initiation and differentiation. A balance between reserve food carbohydrates, available nitrogen and water, in addition to certain proteinaceous nitrogen compounds are reported to have definite influence on fruitfulness of buds (Winkler, 1962). The time and quantity of application of a particular nutrient, especially the major elements N, P and K have a specific role in plant functions. In these studies application of potash at 1740 g per vine during the fruitbud initiation has increased the fruitfulness of buds in third to tenth node considerably. Similar influence of potash has been reported by Stene (1935) and Kobayashi *et al.* (1961). The effect of phosphorous increasing fruitfulness is in agreement with the results obtained by Ballatore (1956) in Sicily, Kobayashi *et al.* (1961) in Japan. However, the authors did not get similar response to nitrogen in their experiments. Probably the nitrogen level of the vines (1.5%) in the experiment would have been above the optimum level. Association of reduced fruitfulness with high petiole nitrate content in certain varieties of California has already been reported by Cook and Krishabha (1956). The increased fruitfulness might be a response to the nutritional status of the plant at the time of initiation. Deposition of carbohydrates and fruit bud initiation are closely associated. A balance between the carbohydrate and nitrogen accumulation serves as a deciding factor in bud initiation.

The influence of K on fruitfulness may be through the build up and utilization of carbohydrates. With the addition of N, the activity of K has been stepped up. Thus, the application of K alone and in combination with N

influenced the C/N ratio favourably at the time of initiation, resulting in increased fruitfulness (Manivel, 1967). Nevertheless, no correlation between the C/N ratio and fruitfulness has been found in the present studies. Therefore attribution of the response to K alone, appears to be over simplification of the complex problem.

Certain amount of shifting of bud fruitfulness towards the distal end of the cane has been observed. When the fruitfulness of buds in 11 to 20th nodes was considered, P had resulted in significant increase of fruitfulness whereas in did not result in such influence in the basal region 3 to 10th This may be due to the delayed or slow availability of P compared to other nutrients.

From the observations reported here it is evident that fruitfulness of buds in Anab-e shahi grapess can be enhanced considerably by judicious and timely application of N, P, K nutrients.

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