

## Uptake and movement of phosphorus ( $^{32}\text{P}$ ) in grapes

by

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Grapes in the peninsular region of India are trained to the overhead arbour system, with the vines set out at different spacings, to accommodate from 100 to 400 vines per acre. Under Indian conditions, information on the uptake and distribution of nutrients applied to the soil in the vines trained to such a system are lacking. Studies were therefore initiated to determine the time between application of the nutrient and its uptake and the mode of movement. Labelled super phosphate was used for this study, which is the first in the series.

ULRICH *et al.* (1947) reported that P applied deep was absorbed by the grapevine within 40 hours of application and accumulated more in young vine parts than in comparatively older parts. Uptake of P within 24 hours of application was observed by EYNAUD (1961) and HIROYASU and TERANI (1963) in the leaves and roots of grapes. KOZMA and POLYAK (1965) found that  $^{32}\text{P}$  was transported spirally in the conducting tissues and accumulated more in young, actively growing shoots of grapes.

### Materials and Methods

In the present study, four moderately vigorous six-year-old vines of Anab-e-Shahi variety, each with a canopy of nine square metres and root spread of 25 square metres, were utilized. The soil in which the vine was growing was calcareous red loam.  $^{32}\text{P}$  labelled superphosphate (250 g), having a specific activity of about 0.12 mCi/g  $\text{P}_2\text{O}_5$ , was applied on February 6th, 1970 (70 days after the pruning of the vine), when the current season's shoot was 60 to 100 cm long. The fertilizer was applied in a circular trench at two different distances, viz. 60 cm and 120 cm, away from the trunk of the vine and at two depths, viz. 15 cm and 22.5 cm, from the surface of soil. The trench was covered and profusely irrigated.

The movement of  $^{32}\text{P}$  in the aerial parts was tested by a Radiation Survey Meter, starting from 6 hours after application. Samples of shoot tips were collected every day for 5 days, while the buds, petioles and laminae were collected on the 6th, 10th and 18th days after application. The samples were analysed for total phosphorus content by vanadomolybdate method (KOENIG and JOHNSON, 1942) and for radioactive phosphorus by the method of MACKENZIE and DEAN (1948). The results were expressed as parts per million of total and fertilizer P, on the dry matter of the plant samples.

### Results and Discussion

The results (Table 1) indicated that the  $^{32}\text{P}$  moved into the aerial parts of the vine within 24 hours of application when it was applied 60 cm from the trunk at 15 cm and 22.5 cm depths. The other two treatments (120 cm distance from the trunk and depths of 15 cm and 22.5 cm) did not show any significant amount of radioactivity at 24 hours and even after 4 days of application. In all the four treatments

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T a b l e 1  
Total and fertilizer P in the shoot tips of grape vine var. Anab-e-Shahi after  $^{32}\text{P}$  application

Treat- ment	Types of P	Just before applic. ppm	1 day after applic. ppm	2 days after applic. ppm	3 days after applic. ppm	4 days after applic. ppm	5 days after applic. ppm	10 days after applic. ppm	18 days after applic. ppm
A	Total P	2700	2500	N.S. <sup>1)</sup>	N.S.	2800	3600	N.S.	N.S.
	Fertilizer P	0	5.7			9.0	32.4		
B	Total P	2700	3500	3000	2900	3500	4600	N.S.	N.S.
	Fertilizer P	0	6.3	15.0	22.6	31.9	63.0		
C	Total P	3900	3200	3700	N.S.	3200	3800	4700	4800
	Fertilizer P	0	0	0		0	10.3	12.2	11.0
D	Total P	3200	3300	N.S.	N.S.	N.S.	3600	4300	3700
	Fertilizer P	0	0.7				4.0	8.2	7.4

<sup>1)</sup> N.S. = Not sampled.

Treatment A: Superphosphate at 250 g/vine at 60 cm away from trunk in 15 cm depth.

Treatment B: Superphosphate at 250 g/vine at 60 cm away from trunk in 22.5 cm depth.

Treatment C: Superphosphate at 250 g/vine at 120 cm away from trunk in 15 cm depth.

Treatment D: Superphosphate at 250 g/vine at 120 cm away from trunk in 22.5 cm depth.

Table 2

Total and fertilizer P in composite sample of laminae, petioles and buds on 6th and 10th days after  $^{32}\text{P}$  application

Treatment	Types of P	6 days after application			10 days after application		
		Lamina ppm	Petiole ppm	Bud ppm	Lamina ppm	Petiole ppm	Bud ppm
A	Total P	2700	5300	3600	4200	7100	5400
	Fertilizer P	19.4	27.6	3.2	50.0	48.3	28.1
B	Total P	3600	7200	4100	5000	9100	6400
	Fertilizer P	42.5	46.1	10.7	128.5	104.7	75.5

Treatments see Table 1.

Table 3

Total and fertilizer P in laminae, petioles and buds at different nodes of shoots of Anab-e-Shahi, on 18th day after application

Treatment	Parts analysed	Types of P	2nd node ppm	4th node ppm	6th node ppm	8th node ppm
B	Laminae	Total P	5600	5000	4700	4800
		Fertilizer P	146.8	142.0	148.0	146.9
	Petiole	Total P	9700	8800	8200	7200
		Fertilizer P	142.6	145.2	109.1	164.2
	Bud	Total P	3600	4400	3800	4800
		Fertilizer P	7.6	11.4	51.7	8.2

Treatment see Table 1.

the uptake of fertilizer P continued to increase after 24 hours with a sharp rise on the 5th day after application.

The P content in the lamina, petiole and bud sampled at random on the 6th and 10th days after application (Table 2) showed a general increase in total and fertilizer P contents from the 6th to the 10th day, with the relative increase in fertilizer P, being more in buds as compared to lamina and petiole. The petioles, in general, had a higher total P content than the lamina or bud.

The P contents of lamina, petiole and buds at different nodal positions of the shoots sampled on the 18th day showed (Table 3) that the total P was highest in petioles, followed by lamina and bud at all the nodal positions. There was a marked decrease in the fertilizer P content in the petiole at the 6th node, with a corresponding increase of fertilizer P in buds at that node. The fertilizer P in the 6th bud was maximum when compared to the fertilizer P in buds at the 2nd, 4th and 8th nodes. It is of interest to note that the 6th node is generally the more fruitful region in this variety of grape.

The study has thus indicated that the application of P within a radius of 60 cm around the vine and at 22.5 cm depth, promoted the uptake of P. ULRICH *et al.* (1947) also reported that the major portion of the active absorbing roots was apparently located within this area.

### Summary

Phosphorus applied into the soil, appeared in the vine shoots within 24 hours of application, and the 6th bud of the shoot, which is generally the most fruitful region of shoots in the Anab-e-Shahi variety of grape, accumulated a high concentration of fertilizer P.

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