GAU Res. J. 1989, 15 (1) 16–20

Nutritional Studies on Buckwheat (*Fagopyrum tataricum*) As a Source of Rutin

G. A. Patel and N. K. Kalyanasundaram

Department of Agricultural Chemistry and Soil Science, Gujarat Agricultural University, Anand Campus, Anand-388 110

ABSTRACT

A study on buckwheat (*Fagopyrum tataricum*) as a source of rutin having 12 combinations of 3 levels of N (0, 50 and 100 kg N/ha) 2 levels of P (0 and 25 kg P_2O_5/ha) and 2 levels of K (0 and 25 kg K_2O/ha) showed that application of 25-25-25 NPK as basal and 25 kg N/ha as top-dress after 25 days was optimum. An inverse relationship existed between the concentration of N and rutin in buckwheat leaves. Besides, nutrient composition of buckwheat leaves at three different growth periods is also reported.

(*Received on 3rd Nov.* 1987)

INTRODUCTION

Rutin, a flavonol glucoside called vitamin-P or permeability factor, is imported by India. Buckwheat (*Fagopyrum tataricum Gaertn*) can be cultivated as a short duration crop of 50 days in Gujarat and it has a potential to serve as a source of rutin in India (Kalyanasundaram and Dalal 1981 ; Patel and Kalyanasundaram. 1984). In the present study nutritional aspects of the crop for obtaining maximum rutin yield were attempted.

MATERIALS AND METHODS

A factorial randomised-block design having three levels of N (0, 50 and 100 kg N/ha) two levels of P (0 and 25 kg P_2O_5/ha) and two levels of K (0 and 25 kg K_2O/ha) with three replications was laid out in loamy sand soil of Gujarat Agricultural University, Anand Campus during winter seasons of 1980-81 and 1981-82. Half of N and all of P and K doses were given as basal. Remaining half of N was top-dressed after 25 days. The pH of the soil was 7.5 in the first site and 7.9 in the second. The soil was deficient in available nitrogen (215-219 kg/ha) but sufficient in other nutrients. The net plot size was 3 m x 1.8 m. The seed rate was 50 kg/ha. The spacing was 60 cm between rows and thinning was not done. Leaves were plucked after 50 days when initiation of seed-setting took place. Green leaf yield was recorded for each net plot and representative samples weighing 50 g from each plot was dried in oven at 50°C for 12 hr. The moisture percentage obtained was used for computing dry

TABLE 1

Effect of different levels of N, P and K on yield and composition of buckwheat leaves.

(Data pooled over two trials)

Treatments	*Green leaf yield kg/ha*	*Dry leaf yield kg/ha*	*Nutrient content (%)*			*Nutrient uptake (kg/ha)*			*Ruitn content %*	*Rutin yield kg/ha*
			N	P_2O_5	K_2O	*N*	P_2O_5	K_2O		
N-level										
N_0	1531	260	2.42	1.24	0.42	6.31	3.26	1.08	6.81	17.6
N_1	2769	470	3.14	1.24	0.43	14.84	5.86	1.98	6.17	29.1
N_2	3260	546	3.44	1.24	0.44	18.83	6.76	2.38	5.63	30.7
C. D. at 5%	103	19	0.06	N. S.	N. S.	0.72	0.34	0.14	0.20	1.3
P-level										
P_0	2426	412	2.96	1.15	0.44	12.75	4.79	1.78	6.19	24.9
P_1	2613	439	3.04	1.33	0.43	13.90	5.79	1.85	6.21	26.7
C. D. at 5%	84	15	0.05	0.05	N.S.	0.59	0.27	N. S.	N. S.	1.0
K-level										
K_0	2463	413	2.92	1.26	0.41	12.57	5.19	1.66	6.20	24.9
K_1	2577	438	3.07	1.21	0.46	14.08	5.39	1.97	6.21	26.8
C. D. at 5%	84	15	0.05	N.S.	0.02	0.59	N. S.	0.12	N. S.	1.0
C. V. %	7	7	3.77	8.07	10.44	9.32	11.31	14.11	5.63	8.38

leaf yield. The dried leaf sample was used for rutin extraction and nutrient analysis. The nutrient contents are expressed in moisture-free basis. Rutin content was estimated following the method of Turner (1952).

RESULTS AND DISCUSSION

Data of only pooled analysis of the 2 trials are presented since interaction between year and treatments was absent. Only those interactions which were significant in the pooled analysis are given.

Leaf yield

The green and dry weight of buckwheat leaves increased with increasing levels of N and K (Table-1). Increase in dry weight of leaves due to N_1 and N_2 over that of control was 81% and 110% respectively. Since soil was deficient in available N, as expected the crop responded to N fertilization. An increase of 6.5% in dry weight of leaves was obtained due to P_1 level over P_0. Available P content of soil was high, still the crop responded to P application probably due to its high P requirement, as reported by Chandel (1980) and Sando (1956). Similarly K_1 level gave 6% higher dry leaf yield than K_0 level. Singh and Atal (1977) observed that application of NPK at 50-40-40 gave higher yield of the herb than the control receiving no fertilizer.

Nutrient content and uptake

Nitrogen content of and uptake by buckwheat leaves increased with increasing levels of N, P and K (Table-1). The percentage increase in N content due to N_1 and N_2 levels was about 30 and 42 respectively in comparison to N_0 level.

Significant interactions between the applications of N and K (Table-2) suggested beneficial effect of K application along with N_1 and N_2 levels in increasing leaf content of N, uptake of N, P and K and rutin yield in comparison to N and N_2 levels without K application. A significant increase in rutin content was registered by N_1K_1 over that of N_1K_0. Though a significant reduction in P content occured due to N_0K_1 as compared to N_0K_0, the differences in P content between N_1K_1 and N_1K_0 as well as N_2K_1 and N_2K_0 were nonsignificant.

TABLE 2

Interaction effect between nitrogen and potash levels on buckwheat leaves. (Data pooled over two trails)

Treatments	*Nutrient content (%)*		*Nutrient uptake (kg/ha)*			*Rutin content %*	*Rutin yield kg/ha*
	N	P_2O_5	*N*	P_2O_5	K_2O		
K_0N_0	2.44	1.30	6.32	3.41	1.04	7.05	18.08
K_0N_1	2.98	1.26	13.74	5.77	1.81	5.94	27.21
K_0N_2	3.37	1.24	17.65	6.39	2.12	5.60	29.28
K_1N_0	2.41	1.17	6.31	3.11	1.12	6.57	17.18
K_1N_1	3.30	1.24	15.94	5.95	2.15	6.41	30.99
K_1N_2	3.51	1.24	20.00	7.12	2.64	5.66	32.16
C. D. at 5%	0.09	0.07	1.02	0.48	0.20	0.29	1.78

Phosphorus content was significantly increased by P application but it was not influenced by N and K levels. Beneficial effect of N application on P uptake was observed per cent increase being 80 and 107 for N_1 and N_2 levels respectively. In contrast, application of P increased its uptake only by 20%. Effect of K level on P uptake was non-significant.

Through K content of leaves was not affected, K uptake was significantly increased due to N application at each level. Increase in K uptake was 83% for N_1 level and 120% for N_2 level over N_0 level. Application of P did not significantly affect the content or uptake of K. Application of K increased content and uptake of K, the increase in the uptake being 19%.

Rutin content and rutin yield

The rutin content decreased significantly with increasing levels of N (Table-1). When higher rate of N increases N content in plant, protein synthesis is increased depressing the synthesis of carbohydrates owing to competition for carbon skeletons. (Beevers, 1976). Since rutin is a flavonol glucoside probably its synthesis is affected by the application of 50 or 100 kg N/ha.

Rutin yield increased with increasing N levels, the per cent increase being 65 and 74 for N_1 and N_2 levels respectively over N_0 level. Though N_2 gave significantly higher rutin yield than N_1 the increase was only 1.6 kg/ha that too at the cost of a significant lowering of rutin content by 0.54%. Considering the cost of doubling the N rate and quality of buckwheat leaves, application of 50 kg N/ha appeared optimum.

Rutin content was unaffected due to P application and rutin yield was increased by 7%. Similar was the effect of K fertilization.

Nutrient composition

Nutrient composition of buckwheat leaves collected from general plot receiving

TABLE 3

Nutrient composition of buckwheat leaves at different growth periods.

Chemical composition	*Days after sowing*		
	15	30	45
N (%)	5.18	4.81	2.80
P_2O_5 (%)	2.83	1.76	1.51
K_2O (%)	0.56	0.54	0.45
Ca (%)	0.76	0.96	1.46
Mg (%)	1.68	2.64	2.40
S (%)	0.38	0.44	0.51
Zn (ppm)	14	44	46
Cu (ppm)	12	35	38
Fe (ppm)	24	119	120
Mn (ppm)	142	107	109

50 kg N/ha, 25 kg P_2O_5 uniformly was also studied (Table-3). Other agronomical practices followed were same as those of the fertilizer trail. Concentration of N, P, K and Mn decreased with increase in plant growth whereas reverse was true for other nutrients.

REFERENCES

Beevers, L. (1976) "Nitrogen metabolism in plants". Edward Ltd., London.

Chandel, K. P. S. (1980) Buckwheat — a neglected crop of hills. *Ind. fmg* **30** : 13-14.

Kalyanasundaram, N. K. and Dalal, K. C. (1981). A note on preliminary work on cultivation aspects of buckwheat (*Fagopyrum tataricum* in Gujarat. *Indian Drugs* **18** : 372.

Patel, G. A. and Kalyanasundaram, N. K. (1984) Harvesting and curing of buckwheat leaves for rutin extraction. *Indian Drugs* **22** : 1-3.

Sando, W. J. (1956) : Buckwheat culture. *Fmr's Bull.* 2095 U. S. Dept. Agric, PP. 23.

Singh Ajit and Atal, C. K. (1977). Cultivation of buckwheat in the plains as a raw material for rutin in "cultivation and utilization of medicinal and aromatic plants" Atal, C. K. and Kapur, B. M. (Ed.), Regional Research Laboratory, Jammu-Tawi PP. 35-37.

Turner, A. (1952) Determination of rutin in buckwheat meal and other plant materials *Anal chem* **24** : 1444-45.