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Studies on the Effect of Nitrogen Fertilization and Methods of Sucker Growth Control Under Two Soil Moisture Regimes on Hookah Tobacco (*Nicotiana rustica*)

V. Nutrient Uptake and Distribution in the Plant

By

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ABSTRACT

The study on the uptake of five major nutrients by Hookah tobacco (*N-rustica*) and their distribution in leaf, stem and suckers showed that tobacco suckers shared nearly 30 per cent of P_2O_5 and were also rich in other nutrients. The pattern of dry matter production and uptake rate of different nutrients indicated the major influence of mean temperature rather than age of the crop. Nitrogen fertilization increased the uptake of all the nutrients studied by virtue of higher dry matter production while chemical suppression of suckers resulted in higher uptake of nitrogen, potassium, calcium and magnesium. Similarly wet soil moisture regime recorded higher nitrogen, potassium and calcium uptake, while magnesium uptake was better under dry regime with no change in phosphorus uptake due to soil moisture variations.

INTRODUCTION

Knowledge on nutrient uptake pattern is not only useful for fixing the manurial schedule and assessment of efficiency in the uptake of applied nutrient but also helps in quality evaluation of crops like tobacco Such an information would also be useful to develop suitable agronomic practices to improve the yield and quality of produce. With this objective a detailed study of nutrient uptake pattern by *Hookah* tobacco was carried out for two years and the results are presented in this paper

MATERIALS AND METHODS

An investigation of *Hookah* tobacco was conducted at the Indian Agricultural Research Institute, New Delhi, during 1963 and 1964 on variety N. P. 219 planted at 60 x 45 cm spacing and grown during summer

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months (Feb.-May) in both the years. The experiment was laid out in factorial randomised block design with following treatments:

N Levels: (N 1) no nitrogen, (N 2) 90 kg N/ha, (N 3) 180 kg N/ha and (N 4) 270 kg N/ha

Sucker growth control methods:

(S 1) Hand suckering and (S 2) Application of N. A. A. (2 per cent in T.E.A.) to the cut end of the stem after topping and repeated after one week.

Soil moisture regimes;

(I_1) Irrigation at 0.3 - 0.45 atmospheres, soil moisture tension (Wet regime) and (I_2) Irrigation at O. 8 atmospheres, soil moisture tension (dry regime).

Nitrogen was applied as ammonium sulphate in two equal doses, half at planting and the rest at 30-45 days after planting depending on irrigation time, while 60 kg/ha each of phosphorus and potassium were applied at planting. Topping was done just about the time of flowering and the harvested produce was subjected to heap curing and then leaf was separated alongwith petiole from the stem. Suckers were

TABLE 1. Mean uptake of nutrients by tobacco crop (kg/ha)

Treatments	Nitrogen			Phosphorus (P_2O_5)			Potassium (K_2O)		
	Leaf	Stem	Sucker	Leaf	Stem	Sucker	Leaf	Stem	Sucker
N_1	31.30	6.08	10.09	5.12	1.78	2.77	26.37	9.11	6.88
N_2	77.75	10.04	17.49	8.77	2.41	4.23	45.64	14.92	12.91
N_3	98.00	12.72	23.59	9.10	2.99	5.44	41.14	16.69	15.20
N_4	110.00	15.35	24.59	8.81	3.08	5.50	44.61	17.14	17.30
S_1	72.97	10.42	19.32	7.86	2.59	4.82	39.56	11.90	13.76
S_2	79.02	10.46	17.47	8.50	2.50	4.35	42.33	16.95	12.12
I_1	77.51	10.51	18.76	8.50	2.62	4.63	42.50	14.44	12.87
I_2	73.34	10 33	18.35	7 76	2.48	4.59	38.62	14.14	13 09
Mean	75.42	10.42	18.55	8.13	2.55	4.61	40 56	14 29	12.98
Per cent distribution	72.25	9 99	17.76	53.17	16.67	30.16	59.79	21.06	19.13

Table 1 [Continued]

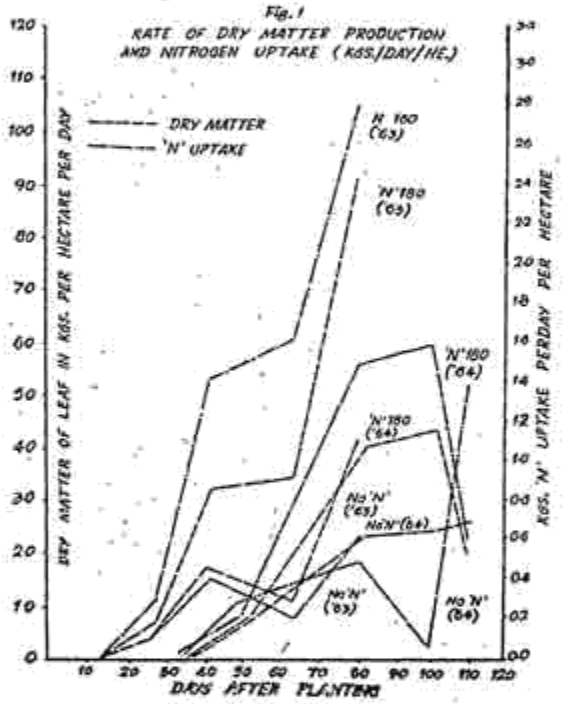
Treatments	Calcium (Ca 0)			Magnesium (MgO)		
	Leaf	Stem	Sucker	Leaf	Stem	Sucker
N_1	72.67	13.76	3.45	34.56	11.40	6.20
N_2	116.59	21.06	8.30	57.70	14.15	5.39
N_3	126.51	22.83	10.36	60.11	15.77	6.00
N_4	142.54	23.62	10.23	62.98	18.74	5.30
S_1	110.19	20.62	9.34	54.60	14.08	6.12
S_2	121.08	19.74	8.16	57.23	15.88	5.38
I_1	125.04	21.30	9.40	53.29	13.99	5.42
I_2	103.84	19.19	8.22	57.30	15.70	6.09
Mean	114.44	20.27	8.81	55.28	14 84	5.75
Per cent distribution	79.74	14.12	6.14	72.88	19.55	7.57

removed periodically as and when required and composite samples were analysed. In both the years, after harvest of the crop the cured leaf and stem samples along with composite samples of suckers (collected from all the suckerings) were oven dried, ground and analysed for total nitrogen, P_2O_5 and K_2O by the methods suggested by Jackson (1958), CaO (Oxalate method) and MgO (Versanate method). However the data on periodical dry matter production and nitrogen uptake were recorded in both the seasons (Fig. 1) and that of periodical P_2O_5, K_2O, CaO and MgO uptake in 1964 alone (Fig. 2 & 3).

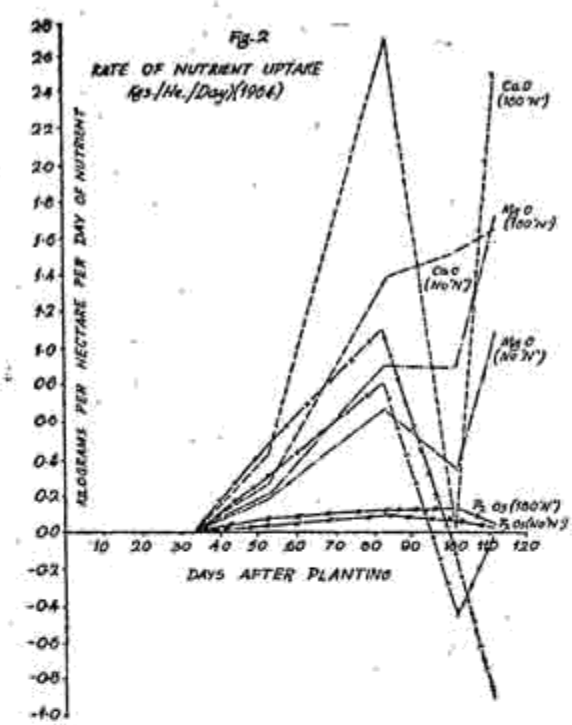
RESULTS AND DISCUSSION

Dry matter production was slow in the early stages of crop growth and maximum growth rate was observed during the month of May (65-81 days crop age) in crop grown in 1963 (Fig. 1). However in the crop of 1964 higher rate of dry matter accumulation was observed even from the month of April (after 54 days age) and continued

till the middle of May. The differences in the trends in two years were attributed to climatic factors, since higher temperature prevailed during April, 1964 compared to the corresponding period in 1963 while the reverse was the case in the month of May. Also the topping of the crop was done in the middle of April in both the seasons following which, increase in rate of dry matter production was observed.



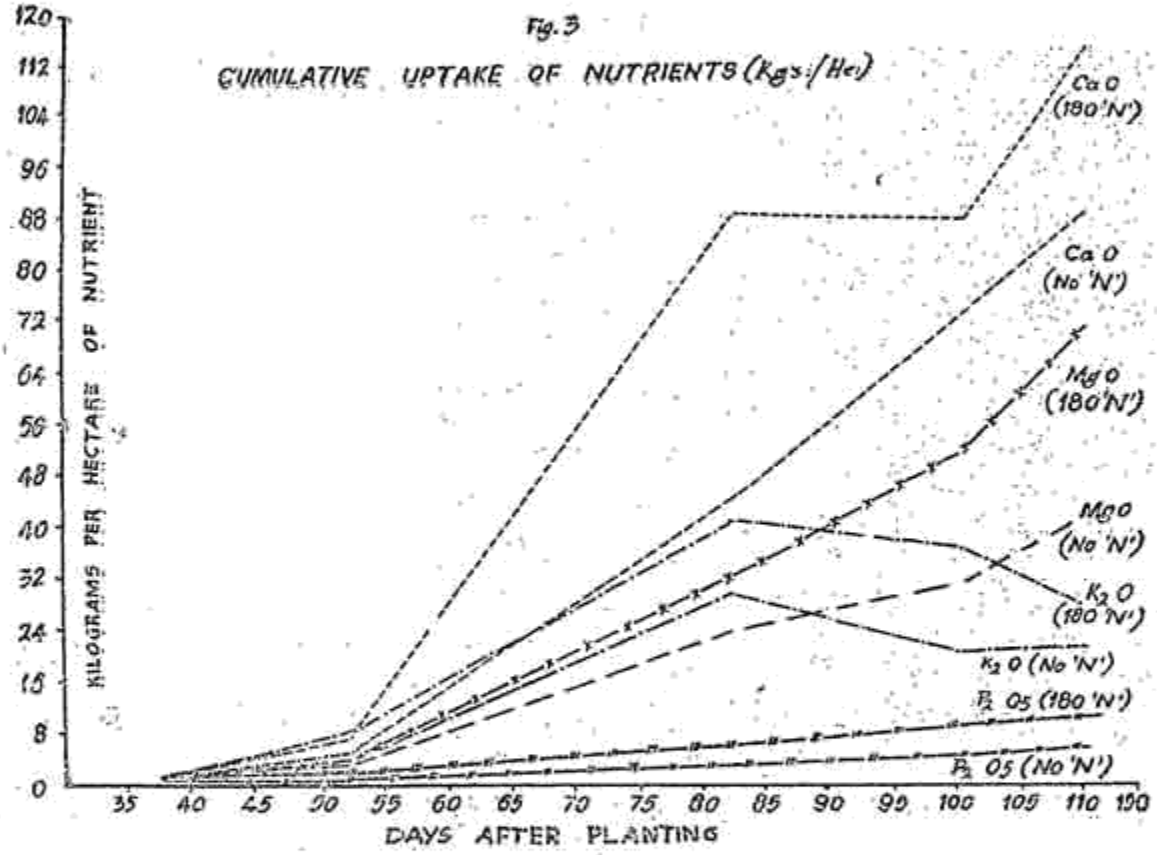
The uptake pattern of several nutrients showed that the peak absorption was during the months of April and May spread over about 50 days. The uptake rate of N and P_2O_5 declined with maturity while that of MgO and to some extent CaO increased. The K_2O uptake was highest by the end of April and thereafter a sharp decline was observed even to the extent of recording the negative value (Fig. 2). Nutrient uptake trends in well manured (180 kg N/ha) and no manure (no nitrogen) crop were almost similar except the differences in magnitude of their uptake (Fig. 3).



Leaf tissue contained largest proportion of all the nutrients taken up by the plant and this tissue accounted for over 70 per cent of the total uptake in the case of nitrogen, calcium and magnesium, while about 55 and 61 per cent of phosphorous and potassium were also found in leaf (Table 1). Occurence of nutrients in tobocco suckers was next only to leaf and they shared P_2O_5 -30.15; K_2O-18.16; N-17.65; MgO-8.47 and CaO-6.27 per cent. The stem tissue contained lesser proportion of nitrogen, phosphorous and potassium compared to suckers while CaO and MgO uptake in stem were better than suckers.

Among the five major nutrients studied (N, P, K, Ca and Mg) average uptake of calcium was highest (143.52 kg/ha) while that of P_2O_5 was the lowest (15.29 kg/ha).

As a result of nitrogen fertilization the mean uptake of all the nutrients increased mainly due to higher dry matter production. Among the three plant parts studied nitrogen fertilization increased nitrogen uptake in the leaf to a largest extent (nearly 3.5 times) followed by the uptake of calcium and magnesium (nearly twofold in both the cases), while the uptake of P_2O_5 and K_2O was increased to lesser extents. Similar influence of nitrogen fertilization on the nutrient uptake (except that of Mgo) in sucker was



also observed and the P_2O_5 and K_2O uptake was particularly high compared to other plant parts.

Between two sucker control treatments, application of N.A.A. tended to increase the uptake of all nutrients (except P_2O_5) compared to hand suckered treatment and major increase was due to higher uptake in leaf tissue under this treatment. Similarly the wet-regime of irrigation also increased N, P_2O_5, K_2O and Ca O uptake while MgO uptake was higher in dry regime.

Between years, there was difference in the extent of nutrient uptake mainly due to differences in dry matter production (yields). The second year crop was particularly affected by root knot nematode (*Meloidogyne* sp.) which had vitiated the response to applied nutrients. Also the soil for the second year crop contained higher level of CaO (18 m. e. / 100) compared to that in first year (11 m. e. /100) while K_2O level in the soil was about the same (203 and 218 kg K_2O/ha). The recovery percentage of applied

nitrogen was calculated in both the years and the data are shown below:

Nitrogen level kg/ha	*Percent recovery of applied Nitrogen*	
	1963	*1964*
0 - 90	79.5	47.4
90 - 180	41.8	22.7
180 - 270	22.0	3.7

During 1963, percent recovery of nitrogen was high compared to that of 1964. The nematode infestation of second year crop and the intensity of gall increased with higher levels of applied nitrogen were considered responsible for such low nitrogen uptake (Prasad *et al*, 1967).

Within the period of two months (April and May) tobacco crop was able to take up (at maximum level) about 170 kg each of N and CaO, 100 kg K_2O, 80 kg MgO and about 19 kg P_2O_5/ ha under best growth conditions (1963) Compared to several other crops in the region, these uptake rates are very high. The capacity of the tabacco plant for such higher rates of nutrient uptake may be due to its high root cation exchange capacity (C. E. C.) viz. 50 m.e./ 100 g of root dry matter. Compared to this green gram (*Phaseolus aureus*) has a root CEC of 35 m. e. / 100 g, maize 14 m. e./ 100g and wheat 9 m.e./ 100 g as reported by Paliwal and Subramaniam (1964). Even the sugarcane crop was reported to have C. E. C. of only about 25.4 and 27.4 m.e./ 100 g dry weight of roots in Co. 997 and Co. 419 varieties, respectively (Narasimham and Pacheco, 1965).

Compared to leaf, tobacco suckers were found to be rich (on per cent dry matter basis) in N, P_2O_5 and K_2O contents and shared considerably in total uptake by the crop. Such loss in nutrients deserves better consideration either by inhibiting their growth or by making better use of these nutrients in the separated suckers.

Working with the same variety of tabacco at IARI, New Delhi, Awatramani (1958) reported the nitrogen uptake range of 16.5 to 49.2 kg/ha while Krishnamurthy (1960) recorded the range from 70.4 to 120.9kg/ha. In both the cases nitrogen removed by the suckers was not considered. The present investigations have put the nutrient uptake on still higher side.

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