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EFFECT OF DIFFERENT LEVELS OF NITROGEN ON THE YIELD, NUTRIENT UPTAKE AND QUALITY COMPONENTS IN JUICE OF SUGARBEET (*Beta vulgaris* L.)

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ABSTRACT

Chemical studies on yield of sugarbeet and quality of juice carried out at Agriculture research station, Sriganganagar revealed that application of N at 120 kg/ha increased the root and top yield, sugar yield and uptake of nitrogen by sugarbeet. Sucrose content was adversely affected by increasing doses of nitrogen.

Impurities, alpha amino-N, and molassegenic compounds like sodium and potassium and overall impurity index in beet juice were increased with increased nitrogen.

Key Words : Nitrogen, yield, nutrient uptake, sugarbeet.

Present beet root production of 675 q/ha with sugar recovery of 10.61 per cent in the country is much lower in comparison to the corresponding other countries (Oberoi and Singh, 1977). This is mainly because of limited knowledge of production technology and lack of research in the field of sugarbeet cultivation.

Optimisation of Agriculture yield and industrial quality is of vital importance for establishment and stability of beet based sugar industry. Nitrogenous fertilizers when used excessively increase impurities levels (alpha amino-N, Sodium and potassium etc.) which deteriorate commercial sugar out put. Research information on this aspect is conspicuous by its absence.

MATERIALS AND METHODS

Chemical studies regarding the effect of different levels of nitrogen on yield and quality of beet juice was carried out at Agriculture Research Station, Sriganganagar, Rajasthan. The experiment was laid down in randomised block. The levels of nitrogen were 0,60,120 and 180 kg N/ha. Total nitrogen for each dose was split into three equal parts one part at the time of sowing and subsequent splits were given at the interval of one month of sowing. Variety used was Ramonskaya-06. Sowing was done by dibbling, keeping row to row distance 50 cm, with a 15 cm distance between the plants. The plot size was 4 x 3 metre. For chemical studies ten plants per plot were selected randomly. The roots were shredded and mixed homogeneously then dried in oven at 70°C to 80°C and finally ground to a fine powder. Total Nitrogen was determined by Macro-kjeldahl method (Sankaram, 1966). Sugar percentage in beet root samples was determined by Sachs le-Docte process outlined by Le-Docte (1977) followed by Carruther's and Old field (1962). Alpha amino-N was determined by colorimetric method with Ninhydrin (Moore and Stein, 1954). Potassium and sodium were determined by flame photometric method following by Carruther's and Old field (1962). Impurity index was calculated by the following formula as suggested by Carruther's and Oldfield (1962).

$$\text{Impurity Index} = \frac{100\text{xppm N} + 3.5\text{xppm Na} + 2.5\text{xppm K}}{\text{Sucrose percentage}}$$

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Gross sugar yield was computed with the help of sucrose percentage and root yield. Nitrogen uptake was calculated by multiplying yield with per cent content of nitrogen.

RESULTS AND DISCUSSION

Beet root and top yield increased significantly upto 120 kg N/ha, indicating that response of nitrogen is a factor that goes upto certain extent and thereafter it becomes constant. Noda *et al.* (1963) registered a continuous increase in top yield with saturation of beet root yield at certain level of nitrogen, However, the present findings are in concurrent to the findings of Adams (1960) and Parasher and Dastane (1973).

Significant increase in gross sugar yield was observed by increasing levels of nitrogen upto the extent of 120 kg N/ha. Further addition of nitrogen, showed adverse effect when compared with 120 kg N/ha of nitrogen application. The result obtained are not in agreement with Doxtator *et al.* (1965), but are in accordance with the results found by Follet *et al.*(1970).

Maximum uptake of nitrogen was obtained under 120 kg N/ha and this value of nitrogen uptake was found close to the uptake recorded by Goodman (1963).

Significant decrease in sucrose content was obtained with increasing levels of nitrogen fertilizer. The present findings confirm an inverse relationship of nitrogen application to sucrose content as reported by Harrod and Caldwell (1967). With increasing supply of nitrogen, the proportion of carbohydrate used in aerial portion may increase while that translocated to the root may decrease (Black, 1957).

Increasing levels of nitrogen appreciably increased alpha amino-N, an impurity which in turn decreased the juice purity indicating that, the excess of nitrogen application is expected to increase the value of impurity index in beet root.

Molassegenic impurity i.e. Potassium content in the juice had been found to increase by the application of nitrogenous fertilizer upto 120 kg N/ha. The decrease in juice purity was also reported by various workers (Doxtator *et al.*, 1965). Another molassegenic impurity the sodium in thin juice of sugarbeet also increased with increasing levels of nitrogen which inferred that increased sodium content accounts in decreasing juice purity by application of nitrogen.

Nitrogen application had increased the impurity index value which is directly related to alpha amino-N, sodium and potassium content of thin juice. Any increase in one of these factors will tend to increase impurity index and reduce

Table 1.Average effect of nitrogen on the yield, nutrient uptake and quality component in juice of sugar beet (pooled)

Treatments	Root yield (t/ha)	Top yield (t/ha)	Total N uptake (kg/ha)	Sucrose (%)	Gross sugar yield (t/ha)	Alpha amino-N (ppm)	K (ppm)	Na (ppm)	Impurity Index
0 kg N/ha	54.0	34.4	190	15.60	8.43	26	1022	129	210
60 kg N/ha	60.3	37.7	222	15.25	9.24	31	1186	195	258
120 kg N/ha	66.9	39.6	241	15.05	10.06	33	1620	236	349
180 kg N/ha	67.7	40.5	222	14.50	9.88	42	1620	272	376
SEM ±	0.50	0.49	6.25	0.10	0.14	0.52	14.60	6.00	9.80
CD at 5%	1.27	1.24	15.88	0.30	0.38	1.32	37.10	16.50	24.90

the purity of the juice. Doxtator *et al.* (1965) have also observed the negative effect of nitrogenous fertilizer on juice purity.

From the results it is clear that in order to get better recovery & quality beet for sugar extraction, excessive use of nitrogenous fertilizer should be restricted.

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REFERENCES

ADAMS, S.N. 1960. The value of calcium nitrate and urea for sugarbeet and the effect of late nitrogenous top dressing. *J. Agric. Sci. Camb.* 54: 395-398.

BLACK, C.A. 1957. "Soil-plant relationship" John Willey and sons". Inc. New York.

CARRUTHER'S, A. and OLDFIELD,J.F.T. 1962. Methods for Assessment of Beet Quality in the Technological Value of Sugarbeet. Elsevier publishing Co. New York. P. 224-48.

DOXTATOR, C.W., FINKNER, R.D. and HELMERICK, R.H. 1965. The performance of sugarbeet selection made for purity and chloride at three levels of nitrogen fertility. *J.Am. Soc. Sug. Beet. Technol.*, **13**: 362-69.

FOLLET, R.F., SCHMEHL, W.R. and VIETS,JR.,F.C. 1970. Seasonal area, dry weight and sucrose accumulative by sugarbeet. *J. Am. Soc. Sug. Beet Technol*, **16**: 235-52.

GOODMAN, P.J. 1963. "Some effect of different soils on composition and growth of sugarbeet. *J. Sci. Fd. Agric.* **14**: 196-203.

HARROD, M.F.J. and CALDWELL, T.H. 1967. The magnesium manuring of sugarbeet on light sandy soils of East. *Anglis. Tech. Mins. Agric. Ed.* **14**: 127-42.

LE-DOCTE, A. 1977. Commercial determination of sugar in beet root using the Sachs-Le-Docte-process. *Int. sug. J.*, **29**: 488-92.

MOORE, S. and STEIN, W. 1954. Determination of amino Nitrogen in blood and urine. *Biol. Chem. J.*, 211, 907.

NODA, K., SUERA, E., KAZUNORI, I. and IOOZAWA,K. 1963. Studies on growing behaviour of sugarbeet plant in the warnot district of Japan II. Effect of nitrogen fertilization on growing behaviour. *Proc. Crop. Sci. Soc.* Japan **32** (1) 26-30.

OBEROI, D.S. and SINGH. 1977. Improved, H.G. Method of Sugarbeet Cultivation. Indian Sugar 27 : 32-35.

PARASHER, K.S. and DASTANE, N.G. 1973. Studies on the effect of soil moisture regimes, plant population and nitrogen fertilization on yield and quality of sugarbeet. *Ind. J.Agro.*, **28**(3): 165-166.

SANKARAM, A. 1966. Laboratory Manual for Agricultural chemistry Asia publishing house 69-70.