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NUTRIENTS UPTAKE PATTERN AND ECONOMIC FEASIBILITY OF DIFFERENT GENOTYPES OF SORGHUM UNDER VARYING NITROGEN AND PHOSPHORUS FERTILIZATION

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ABSTRACT

The nitrogen, phsophorus and potassium content and uptake was higher at $N_{100}P_{50}$ kg/ha application of fertilizers. The highest net monetary return of Rs. 15692 was obtained also at $N_{100}P_{50}$ kg/ha fertility level. Amongst the genotypes, hybrids were efficient in accumulating nitrogen, phosphorus and potassium compared to conventional varieties. The hybrid PJH-58 recorded highest total uptake of nitrogen, phosphorus and potassium followed by PJH-55. The varieties SPV-1025 recorded lowest uptake of NPK. The benefit : cost ratio was higher statistically in hybrids than varieties and PJH-58 was having highest economic desirability and feasibility in terai conditions (Rs. 3.19) compared to other hybrids and varieties. The grain as well as stover yield followed similar trend as observed in nutrients uptake and in net returns.

Sorghum [*Sorghum bicolor* (L.) Moench] is one of the premier food crops and a major staple commodity in several parts of India. In northern India, it is mainly grown as feed and fodder crop. Sorghum is a versatile crop and can be grown over a wide range of climate and soil environments. The diversified uses of sorghum have compounded the demand for increased productions. The quick spreading of high yielding genotypes has changed the scenario of sorghum production in India. The fertilizer being expensive input in crop production is a kingpin in improving productivity of crop particularly of high yielding varieties and hybrids. The determination knowledge of nutrients uptake pattern is an important contributory factor in judicious use of fertilizer in any crop production. It is also established that economic desirability is imperative for successful crop production. Information on these aspects of recently developed varieties and hybrids is lacking of sorghum in tarai conditions. So, the present investigation was undertaken to study the nutrient uptake and economic viability of different genotypes of sorghum.

An experiment on grain and forage sorghum genotypes under varying nitrogen and phosphorus fertility levels was conducted in tarai conditions of G.B.P.U.A. & T., Pantnagar during kharif 1992 and 1993. The soil was light silty clay loam with medium in nitrogen (Total nitrogen .085% in 1992 and 0.081% in 1993) phosphorus (P_2O_5 59.6% kg in 1992 and 61.3 kg in 1993), fertility with fairly good amount of organic carbon (1.08 per cent) and potasium (426.2 in 1992 and 420.3 in 1993 kg K_2O). The experiment was laid out in split plot design with five nitrogen and phosphorus combination levels viz. $N_{20}P_{10}$, N_{40}, P_{20}, $N_{60}P_{30}$, $N_{30}P_{40}$ and $N_{100}P_{50}$ kg/ha in main plot and five genotypes including three new and two checks namely PJH-55, PJH-58 (New hybrids), SPV-1025, (new variety) and CSH-11 (check hybrid) and CSV-13 (check variety) were taken in sub-plots the treatment were replicated thrice and crop was grown with all recommended package and practices. Total nitrogen content in grain and stover was determined by micro Kieldahl method (Jackson, 1967). Total phosphorus content in grain and stover was determined by molybdovanadophosphoric acid method. (Jackson, 1967) and for total K flame Photomentrically after tri acid digestion (Jackson, 1967).

Nutrient content and total uptake

Nitrogen : The pooled data of two years revealed that nitrogen content in grain and in stover increased significantly with nitrogen and phosphorus fertilization simultaneously to crop. In grain, it varied from 1.38 to 1.54 per cent. When nitrogen and phosphorus dose was increased from $N_{20}P_{10}$ to $N_{100}P_{50}$ (Table 1). These results are in agreement with those of Singh *et al.* (1987) who reported that increasing nitrogen levels from 0 to 80 kg/ha increased N contents from 1.34 to 1.76 per cent. Similar was the trend observed of N content in stover. In case of genotypes, higher N content was recorded in hybrids than varieties in

Table 1 : NPK contents, total uptake, net return, beenfit; cost ratio grain yield and stover yield of different genotypes of sorghum at varying Nitrogen and Phosphorus fertilizations.

(Pooled data of two years)

Treatment	Nitrogen Content (%)		Total N uptake (kg/ha)	Phosphorus Content (%)		Total P uptake (kg/ha)	Potassium Content (%)		Total K uptake (kg/ha)	Net returns (Rs./ha)	Benefit : cost ratio	Grain yield (q/ha)	Stover yield (q/ha)
	Grain	Stover	by crop	Grain	Stover	by crop	Grain	Stover	by crop				
Fertility level													
$N_{20}P_{10}$	1.387	0.550	72.86	0.380	0.148	19.76	0.388	1.29	107.38	11288.0	2.66	28.00	72.80
$N_{40}P_{20}$	1.435	0.566	81.38	0.389	0.170	23.23	0.397	1.31	113.65	11719.0	2.65	29.50	78.70
$N_{60}P_{30}$	1.466	0.610	91.89	0.403	0.177	26.10	0.406	1.33	119.48	13498.0	2.87	32.88	81.26
$N_{80}P_{40}$	1.515	0.632	104.46	0.423	0.179	29.23	0.413	1.34	131.70	14732.0	2.94	37.05	88.60
$N_{100}P_{50}$	1.547	0.652	117.61	0.427	0.178	31.85	0.416	1.36	143.98	15692.0	2.95	39.74	96.53
C.D. (5%)	0.047	0.39	7.52	0.027	0.003	1.30	0.007	0.004	13.60	910.0	0.19	3.44	6.49
Genotypes													
PJH-58	1.498	0.626	104.36	0.393	0.175	23.48	0.408	1.33	130.65	15141.0	3.19	38.56	88.00
PJH-55	1.481	0.610	101.01	0.399	0.171	27.76	0.406	1.32	127.28	14420.0	3.02	36.53	86.50
CSH-11	1.482	0.616	95.52	0.427	0.170	26.85	0.404	1.32	122.41	13609.0	2.87	34.56	82.40
CSV-13	1.449	0.577	84.02	0.414	0.162	20.02	0.400	1.31	116.51	12021.0	2.53	29.63	80.90
SPV-1025	1.441	0.584	83.37	0.392	0.160	23.30	0.399	1.30	114.25	12166.0	2.50	28.91	80.10
C.D. 5%	0.36	0.29	6.84	0.025	0.004	1.61	0.003	0.002	9.85	1156.0	0.20	3.82	5.25

both grains and stover. The maximum concentration in the grain was 1.49 was recorded in PJH-58. Similarly, N concentration in stover was 0.63 in PJH-58. The total N-uptake varied from 86 to 117.0 kg/ha. Amongst genotypes, the highest total N-uptake was recorded in PJH-58. The SPV-1025 recorded lowest to the tune of 83.37 kg/ha.

Phosphorus : The phosphorus concentration in grain and stover slowed an improvement with N and P fertilization. The P content in grain varied form 0.380 to 0.427 per cent (Table 1) and in stover, the value varied between 0.148 to 0.179. The reason may be more availability of nutrients to crop plants at higher fertility levels. The similar were the results of Venklatewarlu (1973), who reported higher P concentration under N fertilization from 0 to 150 kg/ha in grain and stover. However, lower P concentration was recorded in hybrids than variety CSV-13, This may be due to dilution effect of P in grains. The highest P-uptake was recorded to the tune of 28.48 kg/ha. Vanderlip (1972) reported 39 kg P uptake in all above ground part of sorghum crop yielding 85 q/ha grain.

Potassium : The nitrogen and P fertilization resulted into higher K content in grain and stover. The K-content in grain varied from 0.388 to 0.416 with increasing $N_{20}P_{10}$ to $N_{100}P_{50}$. Similarly, K-content in stover varied from 1.29 to 1.38 per cent. The highest K-content in grain and stover was recorded under $N_{100}P_{50}$ fertility level. Similar findings were reported by Venketashwarlu (1973). The total K-uptake in fertility levels followed same trend as that of K-contents in grain and stover. The K-content and total uptake were higher in hybrids than varieties. The highest K-uptake was recorded in PJH-58 (130.65 kg/ha) followed by PJH-55.

Grain and Stover yield : The application of $N_{100}P_{50}$ kg/ha produced the highest grain and straw yield (39.74 q/ha and 96.53/ha) of sorghum which was at par with $N_{80}P_{40}$ kg/ha. The lowest grain as well as straw yields were obtained with $N_{20}P_{10}$ kg/ha fertility levels which was at par with $N_{40}P_{20}$ kg/ha amongst the genotypes hybrids outyielded varieties in respect of grain as well as stover yield. The highest grain & straw yield was obtained from PJH-58 followed by PJH-55. Which was at par with check hybrids (CSH-11). The yields and

nutrients uptake pattern followed similar trend under varying fertility levels and genotypes.

Economic studies : Pooled data of two years indicated that increasing the fertility levels increased net returns significantly. Fertility levels $N_{20}P_{10}$ and $N_{40}P_{20}$ being identical were significantly inferior to subsequent higher fertility levels. The significant maximum net returns were accrued from $N_{100}P_{50}$. Increasing nitrogen and phosphorus fertilization from $N_{60}P_{30}$ to $N_{100}P_{50}$ improved the economic viability of crop in both the years. Among the genotypes the higher net returns were obtained by PJH-58 which was on par with PJH-55 but were significantly superior to other genotypes. The varieties CSV-13 and SPV-1025 being identical to each other gave significantly lower net returns as compared to CSH-11.

Similarly, benefit cost ratio differed significantly in genotypes and fertility levels. Amongst, the fertility levels, the highest benefit cost ratio Rs. 2.95 was accrued from $N_{100}P_{50}$ which was statistically at par with $N_{30}P_{40}$ and $N_{60}P_{30}$. The lower fertility levels $N_{20}P_{10}$ and $N_{40}P_{20}$ were identical with each other gave significantly lower benefit cost ratio compared to higher levels. The genotypes among themselves also turned out to be significant. The highest net returns per rupee invested accrued from PJH-58 which were statistically similar with PJH-58 and CSH-11.

The hybrid PJH-58, PJH-55 and CSH-11 gave significantly higher net returns per rupee invested than varieties viz., CSV-13 and SPV-1025.

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