of the two seasons are concurrent on this aspect. This phenomenon is however absent in the seeds treated with sulphuric acid. It would appear that the seed fuzz is able to exert a secondary inhibition in the proper inhibition by some phenomenon unknown so far. It is possible that according to Bailey (1948), the chemical constituents like wax (0.4 to 0.7%) lignin etc. may play a part in retarding the absorption of moisture by certain chemical reaction. It is also possible that these chemical substances may temporarily inactivate the micropyle by concentrated deposition near the funnicle

At this stage, it could be said that there is delayed germination or partial dormancy in the freshly picked seeds and that the same may be overcome by drying the seeds for 30 days and more or alternatively by treatment with sulphuric acid for breaking the dormancy. In either case, it would be advisable to avoid picking seeds from the freshly opened bolls.

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Effect of Nitrogen Levels, Seeding Rates and Cutting on Yield and Protein Content of Sorghum Forage *

by

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Introduction: Sorghum being the popular forage crop of Bihar, can be valuable forage crop for the Chotanagpur region, to meet with the acute fodder scarcity period of November - December and April – June, in the form of silage and sun-dried stalk (hay), since the prospect of *rabi* crop in this region is very dim. This can only be achieved by increasing the quality and yield of this forage in order to make it protein-rich and surplus in *kharif* by suitably adjusting the plant nutrition, plant population and cutting management.

Material and Methods: The treatments for the experiment consisted of four levels of nitrogen (24.7, 49.4, 74.1, and 98.8 kg N/ha as ammonium sulphate), three levels of seeding rate (24.7, 49.4 and 74.1 kg/ha) and two

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treatments of cut once (C_1) and cut twice (C_2) at equal intervals in three months. The experiment was conducted with early maturing local variety 'Gangai' in split plot design replicated thrice with nitrogen in main plots and seed rates and cuttings in sub-plots. Seeds were placed uniformly in the furrows of 45 cm apart. Nitrogen was applied in split doses – half at sowing and rest, 1½ months after sowing, i.e., just after first cut.

Yields on dry matter basis was determined by taking plant material of one square meter at random and drying it in a thermostatically controlled oven at 100° C for 8–10 hours. The total N content of the plant material on dry matter basis was calculated by Kjeldahl's method as per Jackson (1960). N was multiplied by 6.25 for obtaining the protein content.

Results and Discussion: The data on dry matter yield of Sorghum are summarised in Table 1.

TABLE 1. *Effect of N, seedlings rates and cuttings on herbage yield of sorghum (q/ha)*

	S_1	S_2	S_3	Mean	C_1	C_2	Mean
N_1	119.48	124.32	127.55	123.78	119.84	127.73	123.78
N_2	157.69	165.76	170.61	164.69	151.77	177.60	164.69
N_3	177.07	187.11	194.29	186.15	161.46	210.85	186.15
N_4	186.21	199.67	209.36	198.41	163.61	233.22	198.41
Mean	160.11	169.22	174.45	168.26	149.17	187.35	168.26
C_1	143.97	150.96	152.58	149.17			
C_2	176.26	186.47	198.32	187.35			
Mean	160.11	169.22	175.45	168.26			

	S_1C_1	S_2C_1	S_3C_1	S_1C_2	S_2C_2	S_3C_2	Mean
N_1	118.40	120.55	120.55	120 55	128.09	134.55	123.78
N_2	147.46	153.92	152.92	167.92	177.60	187.29	164.69
N_3	155.00	163.61	165.76	199.13	210.61	222.81	186.15
N_4	155.00	165.76	170.07	217.43	233.58	248.65	198.41
Mean	143.97	150.96	152.58	176.26	187.47	198.32	168.26
	(Not significant)						

		C. D. (P=0.05)	C. D. (P=0.01)
Nitrogen	(N)	3.44	5.16
Seed rate	(S)	2.15	2.79
No. of cuts	(C)	1.72	2.26
N × S		4.19	5.59
N × C		3.44	4.62

S. Em. (N×S×C) = ± 2.07

Herbage Yield: It is evident that both the the increased levels of nitrogen and seedling rates resulted in increased herbage yield. Increase in fodder yield of sorghum with increased application of nitrogen is in agreement with earlier findings of Argikar (1955), Burleson *et al.* (1956), Purohit (1960), Ram 1960 and Agarwal *et al.* (1962). Porter *et al.* (1960) found

that the planting rates had little influence on grain yield of sorghum but the heavier planting rates produced the higher yield of forage. The use of higher seed rates together with higher nitrogen levels gave more yield than lower seed rates combined with lower nitrogen levels.

The increased herbage yield of sorghum with higher planting rates and under high levels of nitrogen fertilization may be attributed to the full utilization of nutrients by more number of plants per unit area, owing to the lack of competition for nutrient. Naturally, under adequate supply of plant food, lower the plant population lesser will be the yield. Subramaniam *et al*, (1960) also observed that higher plant population of sorghum grown under adequate manuring resulted in higher yield.

It is interesting to note that the mean yield of herbage of two cuts resulted about 38 per cent increase in yield over the yield of main forage crop cut once. Studying the advantage of ratooning the fodder sorghum, Mukhejee and Chatterjee (1954) also observed that the yield of fodder of the second cut ratoon was as high as 45.6 per cent of the first cut. The total yields of two cuts was 27.7 per cent more than the usual fodder crops. Increased yield of herbage under increased nitrogen levels by cutting the crop twice in a season is in confirmity with the findings of Institute of Agriculture, Padova, Italy (Anon, 1965) and Singh (1957). The latter has reported that a ratoon crop of sorghum for fodder raised under irrigation and fertilized with 145.15 kg and 290.30 kg of ammonium sulphate per acre gave higher yield of fodder than that was given by no fertilizer treatment.

Protein Content: The percentage of protein on dry matter basis as influenced by the different treatment combination is presented in Table 2.

With the increased levels of nitrogen, protein percentages were found to be increasing remarkably whereas with the higher plant density it was found to be decreasing though with a very small variation. Significant increse in protein content of forage sorghum with increased levels of nitrogen has been reported by a number of workers (Burleson *et al.*, 1956; Ram, 1960 and Herron *et al.*, 1963). Since, nitrogen is the chief constituent of protein, its application tended to increase the protein in sorghum. Competition for nitrogen is the most widespread of the forms of nutrient competition. Lower densities might be resulting less plant competition for available nitrogen which in turn brought-forth an increase in nitrogen content in plant body. Similar findings were obtained by Nandpuri (1963), who reported low protein content of dry corn silage with higher population. Qualitative analysis of the herbage sample indicated that at the earlier stages of both after sowing and regrowth, herbage sample contained more protein percentage than the main crop (C_1) in the advanced stage of maturity. Hence cutting the herbage twice in a season not

TABLE 2. *Effect on N, seeding rates and cuttings on protein yield of Sorghum (q/ha)*

	N_1S_1	N_1S_2	N_1S_3	N_2S_1	N_2S_2	N_2S_3	N_3S_1	N_3S_2	N_3S_3	N_4S_1	N_4S_2	N_4S_3
C_1 – Main fodder crop harvested 3 months after sowing	3.65 (3.08)	3.68 (3.03)	3.68 (3.05)	6.35 (4.31)	6.51 (4.23)	6.28 (4.08)	8.68 (5.60)	8.83 (5.40)	8.62 (5.20)	9.72 (6.27)	10.33 (6.23)	10.52 (6 13)
(a) 1st cut fodder taken 1½ months after sowing	2.87 (3.70)	2.80 (3.42)	2.70 (3.14)	4.20 (4,15)	4.33 (4.11)	4.52 (4.04)	6.34 (5.56)	6.42 (5.34)	6.59 (5.19)	7.44 (6.12)	7.88 (6.10)	8.35 (6.06)
(b) 2nd cut taken 1½ months after the 1st cut	1.63 (3.78)	1.61 (3.47)	1.53 (3.16)	2,89 (4.33)	3.06 (4.25)	3.07 (4.08)	4.83 (5.68)	4.99 (5.45)	5 01 (5.23)	6.10 (6.37)	6.59 (6 31)	6.84 (6.17)
C_2 – Total (a+b)	4.50	4.41	4.23	7.09	7.39	7.59	11.17	11.41	11.60	13.54	14.47	15 19

Figures in parenthesis indicate percentage of protein.

only resulted in increased yield (Table 1) but also higher protein recovery per hectare as is evident from the Table 2. Similar findings were also reported by Mukherjee and Chatterjee (1954).

Summary: Results of the investigation carried out at Ranchi Agricultural College, Kanke during *Kharif* 1965 on the dry matter yield and protein content of sorghum are reported in the paper. Nitrogen application of 98.8 kg/ha combined with seeding rate of 74.1 kg/ha and two cuttings at equal interval during growing season out-yielded all other treatment combinations both in respect of protein and dry matter yield of *Sorghum*.

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