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Studies on yield and economics of forage pearl millet (*Pennisetum glaucum* L.) var. GAFB-4 as influenced by nitrogen and weed management

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Abstract
During the *kharif* season of 2021, a field experiment was conducted at the crop research farm of the Department of Agronomy at Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj in the North Eastern plains of Eastern Uttar Pradesh, with the goal of studying the effect of Nitrogen and Weed management on yield, and economics of Forage Pearl millet (Pennisetum glaucum L.) Var. GAFB-4 under the maximum green fodder yield (28.42 t/ha) was achieved with 80 kg/ha nitrogen+ atrazine, according to the data. T8 80 kg/ha nitrogen+ atrazine application yielded a greater net return (61,655.00 INR/ha), gross return (85,263.00 INR/ha), and benefit cost ratio (2.61).

Keywords: Pearl millet, nitrogen, pendimethalin, atrazine, halosulfuron, yield, economics

Introduction
Pearl millet (*Pennisetum glaucum* L.) is India's fourth most important food crop after rice, wheat, and maize. It is well adapted to drought, poor soil fertility, and saline-alkali soils, and it reacts well to irrigation and increased fertility levels. Because it contains less hydrocyanic acid than sorghum, pearl millet is a great pasture crop, and its green fodder is high in protein, calcium, phosphorus, and other minerals, with oxalic acid levels that are below safe limits (Knairwal and Yadav, 2005) [11]. Out of the total fodder crops area of 8.47 million hectares, forage pearl millet accounts for 0.9 million hectares (Anonymous, 2011) [1]. Among the many factors that contribute to low productivity, the lack of proper seed production agronomy is regarded as the most important factor in the success of the bajra fodder crop. Based on the area under cultivation (8.3 m ha) and the availability of quality seed for fodder crops, the current demand for seeds of grown fodder is estimated to be 355000 tonnes annum-1 (Anonymous, 2013) [2]. Lack of breeder seed production farms, lack of better variety of fodder for seed production, and lack of seed production agronomy for particular crop/variety are among the several obstacles that are combining to provide appropriate quantity of quality seed. The commercial part of forage seed production is not seed, and the fodder crop is frequently taken before seed set, posing a unique dilemma. Nitrogen and weed management have been found as a major contributory factor for the production of forage bajra seed, among other reasons restricting bajra productivity.

Nitrogen is a crucial ingredient and a major constituent of protein and nucleic acid, which increases protoplasm production in plant bodies, photosynthesis, plant size, yield contributing features, and crop yield (Meena *et al*., 2012). Weed control is also a significant component for boosting the productivity of pearl millet, as weeds compete for nutrients, water, light and space with crop plants during early growth period (Bahadur *et al*., 2015) [4]. According to Banga *et al*., (2000) [3], a 55 percent yield drop in the pearl millet crop was reported due to high weed infestation. Due to the presence of weed flushes in bajra, postemergence herbicides must be examined for broader spectrum weed control. Only using pre-emergence herbicides (atrazine, pendimethalin, etc.) results in the emergence of weeds that are resistant to these herbicides because they are only effective for the first 35-40 days, resulting in a significant infestation of late-emerging weeds. As a result, a comparative study of various weed management techniques in bajra is required, as well as the development of an integrated weed management strategy that is both efficient and cost effective of forage seed production is not seed, and the fodder crop is frequently taken before seed set, posing a unique dilemma. Nitrogen and weed management have been found as a major contributory factor for the production of forage bajra seed, among other reasons restricting bajra productivity.

Materials and Methods

To determine how the use of nitrogen and weed management affects pearl millet (*Pennisetum glaucum* L.) growth parameters and productivity, the study was conducted in Shaits Prayagraj in the course of the *kharif* season of 2021 at CRF of wing of Agronomic located at 25o24'42" N latitude, 81o50'56" E longitude and 98 m above mean sea degree (MSL). Within a Randomized Block design, nine medicines were randomized and then multiplied a total of three times. Every treatment website layout has a 3m 3m dimension. Potassium with supplies of Muriate of Potash, as well as Nitrogen via Urea and Phosphorus via DAP, can be categorized as a treatment with appropriate doses of Potash. T1 – 50 kg N/ha + Pendimethalin, T2 – 50 kg N/ha + Atrazine, T3 – 50 kg N/ha + Halosulfuron, T4 –65 kg N/ha + Pendimethalin, T5 – 65 kg N/ha + Atrazine, T6 – 65 kg N/ha + Halosulfuron, T7 – 80 kg N/ha + Pendimethalin, T8- 80 kg N/ha + Atrazine, T9 – 80 kg N/ha + Halosulfuron. The pearl millet crop was harvested treatment wise at harvesting maturity stage. Growth parameters *viz*. plant height (cm), dry matter accumulation g plant^{-1} were recorded manually on five randomly selected representative plants from each plot of each replication separately and after harvesting, seeds were separated from each net plot and were dried under sun for three days. Later winnowed, cleaned and seed yield per ha was computed and expressed in tonnes per hectare. After complete drying under sun for 10 days stover yield from each net plot was recorded and expressed in tonnes per hectare. The data was computed and analyzed by following statistical method of Gomez and Gomez (1984) [10]. The benefit: cost ratio was worked out after price value of green fodder and total cost included in crop cultivation.

Results and Discussions

Effect on growth parameters

Yield

Green Fodder yield

It was found that 80 kg/ha nitrogen + atrazine caused the highest green fodder production (28.42 t/ha), however, 65 kg/ha nitrogen + atrazine, 80 kg/ha nitrogen + pendimethalin, & 80 kg/ha nitrogen + halosulfuron were statistically on par with 80 kg/ha nitrogen + atrazine. As nitrogen is applied to many physiological stages of plant growth, such as photosynthesis, root growth and development, as well as more dry matter and its distribution, the sink capacity of the crop is increased and the green fodder production. It can also be concluded that effective management of weeds with profitable seed yield of forage pearl millet can be obtained with 100 kg N ha with the application of atrazine (PE) at 25 DAS. In the areas of dominance of Cyprus rotundus presence, the application of atrazine (PE) fb halosulfuron (POE) at 25 DAS would be the better option also in 2018, Choudary *et al*., reported parallel findings.

Economics

In a comparison of different combinations of fertilizer source and weed management, the 80 kg/ha nitrogen+ atrazine combination recorded the highest Green Fodder yield (28.42 t/ha), gross return (85,263.00 INR/ha), net return (61,655.00 INR/ha) and benefit cost ratio (2.61**).**

Table 1: Effect of Nitrogen and Weed Management on yield characters of Forage pearl millet var. 'GAFB - 4'

S. No	T. No	Treatments	Green Fodder Yield (t/ha)
1	T_1	50 kg/ha nitrogen + pendimethalin	24.28
2	T_2	50 kg/ha nitrogen + atrazine	24.41
3	T_3	50 kg/ha nitrogen + halosulfuron	22.00
4	T_4	65 kg/ha nitrogen + pendimethalin	25.70
5	T_5	65 kg/ha nitrogen + atrazine	26.46
6	T_6	65 kg/ha nitrogen + halosulfuron	25.47
7	T_7	80 kg/ha nitrogen + pendimethalin	27.87
8	T_8	80 kg/ha nitrogen + atrazine	28.42
9	T_9	80 kg/ha nitrogen + halosulfuron	26.84
		SEm (±)	0.67
		CD (P 0.05)	1.99

Table 2: Effect of Nitrogen and Weed Management on economics of Forage pearl millet var. 'GAFB - 4'

S. No	T. No.	Treatments	Cost of cultivation (INR)	Gross return (INR)	Net return (INR)	Benefit Cost ratio
1	T_1	50 kg/ha nitrogen + pendimethalin	24,318.00	72,834.00	48,516.00	2.00
2	T_2	50 kg/ha nitrogen + atrazine	23,218.00	73,224.00	50,006.00	2.15
3	T_3	50 kg/ha nitrogen + halosulfuron	26,318.00	65,996.00	39,678.00	1.51
4	T_4	65 kg/ha nitrogen + pendimethalin	24,513.00	77,094.00	52,581.00	2.15
5	T_5	65 kg/ha nitrogen + atrazine	23,413.00	79,374.00	55,961.00	2.39
6	T_6	65 kg/ha nitrogen + halosulfuron	26,513.00	76,416.00	49,903.00	1.88
7	T_7	80 kg/ha nitrogen + pendimethalin	24,708.00	83,616.00	58,908.00	2.38
8	T_8	80 kg/ha nitrogen + atrazine	23,608.00	85,263.00	61,655.00	2.61
9	T_9	80 kg/ha nitrogen + halosulfuron	26,708.00	80,517.00	53,809.00	2.01

#Data not subjected to statistical analysis.

Conclusion

With treatment 80 kg/ha nitrogen+ atrazine, the highest Green Fodder yield (28.42 t/ha), highest gross return (85,263,00 INR/ha), highest net return (61,655,00 INR/ha), and highest benefit-to-cost ratio (2.61), Farmer's may prefer this choice since it is economically more profitable, and hence, recommended to the farmers.

Future Scope

The conclusion drawn are based on one season data only which needs further confirmation for recommendations.

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