The Pharma Innovation Journal 2023; 12(11): 1753-1756

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(11): 1753-1756

www.thepharmajournal.com
Received: 02-09-2023
Accepted: 08-10-2023

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Studies on integrated nutrient and weed management strategies of French bean (*Phaseolus vulgaris* L.) cultivation

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Abstract
An experiment entitled "Effect of Integrated nutrient and weed management in French bean (*Phaseolus vulgaris* L.) with an objective to study the growth and yield behaviour of French bean under the influence of herbicide application and integrated nutrient management was conducted at the Pili Kothi Research Farm of Tilak Dhari Post Graduate College, Jaunpur, Uttar Pradesh during the *Rabi* seasons of 2018-19 and 2019-20, respectively. The experiment was laid out in Split plot design with 5 levels of weed management practices in main plot and 4 levels of nutrient management treatments in sub-plot and replicated thrice. This investigation recorded significantly higher plant height (cm), no of branches plant^{-1}, pod length (cm), number of pods plant^{-1}, number of unfilled pods (minimum), number of grains pod^{-1}, 100 grains weight (g), grain yield (kg ha^{-1}), straw yield (kg ha^{-1}) and biological yield (kg ha^{-1}) under two hand weeded (20 & 40 DAS) plots. Among the herbicide application, Imazethapyr @ 50 g a.i. ha^{-1} at 20 DAS (W_4) was significantly superior to all other herbicide in respect to growth and yield attributes of French bean. The doses and sources of nutrients have significant influence on growth and yield of French bean. Significantly highest yield and attributing parameters were registered with 100 percent RDF.

Keywords: French bean, weed, *Rabi*, imazethapyr, integrated, growth, yield

Introduction

French bean (*Phaseolus vulgaris* L.) is an important leguminous vegetable and short duration crop. French bean is an important source of dietetic protein for more than 500 million persons in Latin America and other countries. It is the most extensively grown as green vegetable named as French bean, common bean, snap bean, green bean, when used as green pods. Similarly, when used as seed, it is called haricot bean, Rajmash, dry bean, navy bean *etc*. French bean (*Phaseolus vulgaris* L.) commonly known as Rajmash is an important pulse crop with 21.1 percent of grain protein, 69.9 percent of carbohydrates, 1.7 percent of fat besides 381 mg calcium, 42.5 mg phosphorus and 12.4 mg iron per 100 g of edible parts (Ali and Kushwaha 1987) [1]. The reduction of French bean productivity can be attributed to various factors, with the major factors being the contribution of nutrient and weed management. If the optimal nutritional conditions are maintained and the sources of nutrients are carefully adjusted, while also effectively controlling the growth of unwanted plants, the productivity of French beans can be further improved. This will enable the exploitation of the full potential productivity of the modern varieties.

Weeds play a substantial role in impeding crop production and are accountable for the greatest extent of harm caused by all pests. They partake in a competitive relationship with crop plants to obtain crucial resources like moisture, nutrients, light, and space, consequently depriving the crop of indispensable inputs. French bean crops frequently experience the presence of different kinds of weeds, encompassing grassy, non-grassy, and sedges weeds. The manifestation of these weeds is contingent on various factors, such as environmental conditions (e.g., humidity, temperature, and moisture availability), alongside soil type, cultural practices, and crop rotation methodologies employed. Among the various methods employed to control weeds, the use of herbicides assumes great importance when manual or mechanical weeding is not possible.

The utilization of chemical fertilizers has significantly enhanced agricultural production. However, farming communities are utilizing these fertilizers in an indiscriminate manner, particularly in areas where irrigation facilities are available and with the intention of cultivating two to three crops per year. Unfortunately, this practice has led to the depletion of soil resources and subsequent loss of soil productivity. Consequently, farmers are compelled to apply higher quantities of fertilizers in order to maximize their returns. This trend has resulted in a continuous increase in the utilization of fertilizers, leading to the unsustainable extraction of nutrients from the soil. Despite the pressing necessity for intervention, there has been a conspicuous deficiency in the allocation of focus to the regulation of nutrient utilization within various soil and climatic circumstances, particularly in the realm of French bean cultivation.

Materials and Methods

The experiment was conducted at Pili Kothi College Research Farm of Tilak Dhari Post Graduate College, Jaunpur, Uttar Pradesh during *Rabi* season 2018-19 and 2019-20, respectively. Which is geographically situated between 25.74° N latitude to 82.68° E longitude and at an altitude of 82 m above mean sea level. The seed of French bean cultivar HUR-137 (Hindu University Rajma-137) had been used for sowing of experiment.

A comprehensive examination of 20 distinct treatments was performed using a split plot design, which involved three replications. The main plots were dedicated to the allocation of 5 weed management practices, while the subplots were utilized to allocate 4 nutrient management strategies. The treatment comprised five weed management practice, [W_1: Weedy check (Control), W_2: Pendimethalin @ 1.25 kg a.i. ha^{-1} as pre emergence, W_3: Quizalofop-ethyl @ 50 g a.i. ha^{-1} at 20 DAS, W_4: Imazethapyr @ 50 g a.i. ha^{-1} at 20 DAS and W_5: Two hand weeding at 20 and 40 days after sowing] and four nutrient management treatments (N_1: 75% RDF, N_2: 75% RDF + 25% N through Vermicompost, N_3: 75% RDF + 25% N through FYM and N_4: 100% RDF). The experimental field was divided into 60 plots. Each gross plot size was 15 m^2 (5×3 m^2) and net plot size was 9.6 m^2 (4×2.4 m^2). The inter-row spacing was consistently upheld at a distance of 30 cm, while the intra-row spacing was set at a distance of 10 cm.

Results and Discussion

In comparison to the first year of the treatment application, the growth characteristics, yield attributes, and overall yield showed an increase in the second year. Significantly higher plant height (cm), number of branches $plant^{-1}$, pod length (cm), number of pods $plant^{-1}$, number of unfilled pods (minimum), number of grains pod^{-1}, 100 grains weight (g), grain yield (kg ha^{-1}), straw yield (kg ha^{-1}) and biological yield (kg ha^{-1}) were recorded with two hand weeding at 20 and 40 days after sowing (W_5) among the herbicide application of Imazethapyr @ 50 g a.i. ha^{-1} at 20 DAS (W_4) showed its superiority over rest of the applied herbicide in respect to growth parameters, yield and attributing characters.

The findings demonstrated that the augmentation in factors that contribute to yield and the enhanced yield were a result of the limited presence of weeds and the diminished competition between crops and weeds at the crucial stage of growth. Consequently, these circumstances facilitated the optimal utilization of resources by the crops for their growth, thereby leading to advancements in both the characteristics and overall yields Imazethapyr displays inhibitory effects towards acetolactate synthase (ALS), an indispensable enzyme involved in the synthesis of leucine, valine, and isovaline (Stidham and Singh, 1991) [7]. The interventions, namely manual removal of weeds and application of herbicides, which exhibited elevated levels of dry matter, yielded increased amounts of straw and biological matter. Corresponding observations were documented by Singh *et al*. (2003) [6], Chavan, *et al*. (2019) [2], and Hamid and Rasool (2021) [3].

The value of yield attributes and growth characters namely plant height (cm), number of branches $plant^{-1}$, pod length (cm), number of pods $plant^{-1}$, number of grains pod^{-1}, 100 grains weight (g), grain yield (kg ha^{-1}), straw yield (kg ha^{-1}) and biological yield (kg ha^{-1}) increased significantly due to 100% RDF (F_4), the potential cause of this occurrence could be attributed to the direct influence of nitrogen on the growth of seeds, as well as its indirect contribution in facilitating the adjustment of osmotic imbalances that are present during the final stage of seed filling. In comparison to other legumes, the reaction to sporadic nitrogen application until the middle stage of pod filling is a result of its greater seed dimension, shorter period of growth, and simultaneous flowering pattern. Balanced and optimum supply of phosphorus and potassium resulted in optimum growth which resulted in better yield attributes and yield. Phosphorus plays a crucial role in the conversion of energy within nodules. Furthermore, phosphorus also has a significant impact on root development, nutrient absorption, and the growth of leguminous crops. However, the majority of agricultural soils lack sufficient amounts of phosphorus to facilitate efficient biological nitrogen fixation due to its presence in chemically stable compounds that are least available to plants. Potassium serves as an activator for numerous enzymes within the plant system, particularly those involved in protein synthesis. Additionally, potassium plays a vital role in maintaining osmotic balance within the plant. Moreover, potassium is essential for the proper development and functioning of root nodules. The provision of a balanced and optimal supply of both phosphorus and potassium leads to ideal growth, resulting in improved yield and yield attributes. Similar findings have been reported by Jan *et al*. (2019) [4], Hamid and Rasool (2021) [3], and Kumar *et al*. (2021) [5].

Table 1: Effect of different treatments on plant height and number of branches at 40 & 60 days stages of crop growth

Treatments	Plant height (cm)				Number of branches $plant^{-1}$			
	40 DAS		60 DAS		40 DAS		60 DAS	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
(A) Weed management								
W_1	22.43	23.06	28.70	29.81	7.06	7.51	9.69	9.72
W_2	25.49	26.64	34.40	35.73	8.51	8.95	11.82	11.90
W_3	26.32	26.80	31.94	33.18	7.74	8.18	10.98	11.10
W_4	27.42	28.06	34.95	36.31	8.56	9.02	12.06	12.12
W_5	28.51	29.28	41.11	42.71	9.45	10.02	12.86	12.95
S.Em±	0.04	0.05	0.11	0.07	0.04	0.04	0.18	0.18
CD (P=0.05)	0.13	0.16	0.37	0.22	0.13	0.13	0.57	0.58
(B) Nutrient management								
F_1	24.47	24.89	31.92	32.65	7.95	8.44	11.13	11.19
F_2	26.58	27.40	34.97	36.55	8.36	8.11	11.60	11.69
F_3	25.97	26.86	33.92	35.51	8.22	8.63	11.44	11.53
F_4	27.12	27.93	36.06	37.50	8.53	9.05	11.75	11.83
S.Em±	0.02	0.04	0.09	0.06	0.03	0.04	0.15	0.16
CD (P=0.05)	0.06	0.11	0.25	0.19	0.10	0.11	0.45	0.45

Note: (W_1) Weedy Check (Control), (W_2) Pendimethalin @ 1.25 Kg a.i. ha^{-1} at pre-emergence, (W_3) Quizalofop-ethyl @ 50 g a.i. ha^{-1} at 20 DAS (W_4) Imazethapyr @ 50 g a.i. ha^{-1} at 20 DAS (W_5) Two hand weeding at 20 & 40 days after sowing, (F_1) 75% RDF, (F_2) 75% RDF + 25% N through vermicompost, (F_3) 75% RDF + 25% N through FYM, (F_4) 100% RDF.

Table 2: Effect of different treatments on yield attributes

Treatments	Yield attributes									
	Pod length (cm)		No. of pods $plant^{-1}$		No. of unfilled pods		No. of grains pod^{-1}		100 grain weight (g)	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
(A) Weed management										
W_1	8.75	9.28	8.36	8.57	3.43	3.22	2.27	2.43	47.96	48.86
W_2	10.42	11.05	10.35	10.66	2.76	2.59	2.82	3.01	50.05	50.95
W_3	9.38	9.94	9.17	9.42	2.43	2.27	2.69	2.88	49.25	49.89
W_4	11.17	11.84	11.04	11.37	2.05	1.93	3.34	3.57	50.85	51.50
W_5	13.51	14.32	12.69	13.11	1.16	1.09	4.41	4.72	54.04	55.14
S.Em±	0.22	0.23	0.20	0.21	0.20	0.19	0.16	0.17	1.13	1.67
CD (P=0.05)	0.70	0.75	0.67	0.70	0.64	0.60	0.53	0.56	3.67	5.44
(B) Nutrient management										
F_1	9.82	10.41	9.44	9.70	2.65	2.48	2.76	2.96	47.74	48.11
F_2	10.84	11.49	10.37	10.67	2.43	2.29	3.10	3.32	50.91	51.15
F_3	10.45	11.08	10.25	10.55	2.48	2.33	3.05	3.26	50.04	50.39
F_4	11.47	12.16	11.23	11.58	1.89	1.78	3.51	3.75	53.04	55.41
S.Em±	0.20	0.21	0.19	0.20	0.16	0.15	0.14	0.15	1.06	1.40
CD (P=0.05)	0.57	0.61	0.54	0.57	0.47	0.45	0.40	0.43	3.07	4.04

Note: (W_1) Weedy Check (Control), (W_2) Pendimethalin @ 1.25 Kg a.i. ha^{-1} at pre-emergence, (W_3) Quizalofop-ethyl @ 50 g a.i. ha^{-1} at 20 DAS (W_4) Imazethapyr @ 50 g a.i. ha^{-1} at 20 DAS (W_5) Two hand weeding at 20 & 40 days after sowing, (F_1) 75% RDF, (F_2) 75% RDF + 25% N through vermicompost, (F_3) 75% RDF + 25% N through FYM, (F_4) 100% RDF.

Table 3: Effect of different treatments on yield.

Treatments	Yield					
	Grain yield (kg ha^{-1})		Straw yield (kg ha^{-1})		Biological yield (kg ha^{-1})	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
(A) Weed management						
W_1	915.40	925.20	1339.32	1351.10	2255.33	2276.31
W_2	1566.89	1592.56	2149.43	2158.37	3716.33	3750.93
W_3	1513.56	1545.45	2132.12	2153.07	3645.69	3698.53
W_4	1870.23	1889.31	2337.52	2355.49	4207.75	4244.81
W_5	1999.78	2020.70	2648.25	2665.56	4648.03	4686.26
S.Em±	1.46	1.18	2.40	3.12	2.75	3.70
CD (P=0.05)	4.80	3.92	7.97	10.34	9.12	12.26
(B) Nutrient management						
F_1	1493.37	1511.10	2032.36	2049.24	3525.73	3560.35
F_2	1601.26	1619.40	2156.16	2168.55	3757.43	3787.95
F_3	1539.88	1564.65	2086.58	2105.63	3626.46	3670.28
F_4	1658.19	1683.43	2210.69	2223.46	3868.88	3906.89
S.Em±	2.20	1.26	2.19	1.70	3.37	2.27
CD (P=0.05)	6.40	3.67	6.37	4.96	9.78	6.60

Note: (W_1) Weedy Check (Control), (W_2) Pendimethalin @ 1.25 Kg a.i. ha^{-1} at pre-emergence, (W_3) Quizalofop-ethyl @ 50 g a.i. ha^{-1} at 20 DAS (W_4) Imazethapyr @ 50 g a.i. ha^{-1} at 20 DAS (W_5) Two hand weeding at 20 & 40 days after sowing, (F_1) 75% RDF, (F_2) 75% RDF + 25% N through vermicompost, (F_3) 75% RDF + 25% N through FYM, (F_4) 100% RDF.

Conclusion
On the basis of the experimental results, it was indicated that the herbicide treatment imazethapyr @ 50 g a.i. ha^{-1} at 20 DAS spray was an efficient way to reduce weeds and increase the yield of French beans.

References
1. Ali M, Kushwaha BL. Cultivation of *Rabi* Rajmash in Plains. Indian Fmg. 1987;31(2):20-23.
2. Chavan KA, Suryavanshi VP, Patil AA. Effect of integrated weed management on growth of kharif French bean (*Phaseolus vulgaris* L.). J. Pharmacogn. Phytochem. 2019;8(4):113-116.
3. Hamid S, Rasool S. Productivity of French bean (*Phaseolus vulgaris* L.) as influenced by Integrated Nutrient and Weed Management. Int. J Adv. Techn. Sci. Res. 2021;2(2):117-130.
4. Jan R, Ali T, Mushtaq N, Bhat SA, Nabi BB, Farooq K. Effect of Integrated Nitrogen Management on Growth Performance of French Bean (*Phaseolus vulgaris* L.) *Var*. Contender under Temperate Conditions of Kashmir Valley. C. J App. Sci. Tech. 2019;38(6):1-9.
5. Kumar V, Kumar RM, Kumar D, Rawat AK, Yadav L, Singh BP. To study the effect of integrated nutrient management (INM) on growth parameters and yield attributing characters of French bean cv. Azad $Rajmah^{-1}$. Int. J Chemi. Stud. 2021;9(2):681-684.
6. Singh MK, Tripathi SS. Study on chemical weed control in French bean (*Phaseolus vulgaris* L.) under Tarai of Uttaranchal. Crop Res. 2003;25:215-218.
7. Stidham MA, Singh BK. Imidazolinone-acetohydrooxy acid synthase interactions 71–90. In: The imidazolinone herbicides (Eds. Shaner DL and Conner SLO). Boca Raton (FL, USA): CRC Press; c1991.