Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(3): 826-828
Received: 11-03-2018
Accepted: 15-04-2018

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Study of effect of different integrated nutrient management practices on seed quality in French bean

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Abstract
An experiment on integrated nutrient management in french bean was conducted during 2016-17 with the treatments being T_1 (RDF), T_2 (RDF + lime), T_3 (75% RDF), T_4 (75% RDF + lime), T_5 (75% RDF +25% FYM), T_6 (75% RDF + 25% FYM + lime), T_7 (75% RDF + 25 % vermicompost), T_8 (75% RDF + 25% vermicompost + lime), T_9 (75 % RDF + 12.5 % vermicompost + 12.5 %FYM + lime), T_{10} (50% RDF +25% FYM + 2 foliar spray), T_{11} (50% RDF +25% vermicompost + 2 foliar spray). Observations on seed quality parameters like vigour index, germination percentage and seedling dry weight were taken and conclusion were made. As per the observations, the highest vigour index-1 and vigour index-II was recorded in T_9 (3817.8) and T_7 (12731) respectively. The highest germination percentage was found with T_8 (92.00) followed by 91.30 in (T_3) and the dry weight of the seedling was highest in T_7 (0.146g) followed by T_5 (0.134g) and T_1 (0.123g).

Keywords: French bean, vigour index, germination percentage, seedling dry weight

Introduction
French bean (*Phaseolus vulgaris*) is one of the most important and popular legume vegetable cultivated in Rabi season in Odisha. There is good demand of this vegetable in Odisha. However sufficient good quality seed is not produced in Odisha. There is a worldwide consensus that sole dependence on chemical input based agriculture is not suitable in long run and only integrated plant nutrient systems (IPNS) involving a combination of fertilizer, organic manure and bio-fertilizers are essential to sustain crop production, preserve soil health and biodiversity. In addition to this, organic manures help in improving the use efficiency of inorganic fertilizers. The basic concept of integrated nutrient management system is the maintenance of Plant nutrients supply to achieve a given level of crop production by optimizing the benefits from all possible sources of plant nutrients in an integrated manner, appropriate to each cropping system and farming system. The advantage of combining organic and inorganic sources of nutrients in integrated nutrient management has been proved superior to the use of each component separately.

The availability of quality seed is of utmost importance for increasing the vegetable production. The package of seed production technology varies from location to location and from crop to crop. The most important and feasible approach to enhance the productivity of vegetable crops would be the production of quality seeds and making its availability. The importance of good quality seed can hardly be over emphasized as it is crucial for high productivity.

Quality seed production in French bean and seed availability is a felt need among the farmers. So, the experiment was designed to study the effect of different nutrient management on quality of seeds of French bean under coastal agro climatic zones of Odisha.

Material and Methods
This experiment was carried out during Rabi season of 2016-17 in the Horticultural Research Station of Department of Vegetable Science, College of Agriculture, Orissa University of Agriculture and Technology, Bhubaneswar, Odisha. French bean variety Swarna Priya collected from ICAR research complex for eastern region (ICAR-RCER) Ranchi was taken for trial during the course of investigation. Swarna Priya is a promising French bean variety, developed through pure line selection at ICAR research complex Palandu, Ranchi. Pods are flat, green, Fleshy having good cooking quality. Dried seeds are bold and maroon in colour, suitable for rajma preparation. The variety is high yielding and performed well for fresh pod production at Bhubaneswar climatic condition.

The trial was conducted in RBD with three replications and eleven treatments. The treatments are T_1 (RDF), T_2 (RDF + lime), T_3 (75% RDF), T_4 (75% RDF + lime), T_5 (75% RDF +25% FYM), T_6 (75% RDF + 25% FYM + lime), T_7 (75% RDF + 25 % vermicompost), T_8 (75% RDF + 25% vermicompost + lime), T_9 (75 % RDF + 12.5 % vermicompost + 12.5 %FYM + lime), T_{10} (50% RDF +25% FYM + 2 foliar spray), T_{11} (50% RDF +25% vermicompost + 2 foliar spray). [RDF: Recommended Dose of Fertilizer for French bean was 120:60:60 kg NPK ha^{-1}, Soluble fertilizer 19:19:19 was sprayed @7.5gm/liter, Lime @5q/ha was applied.]. Decomposed compost and vermicompost were purchased and applied in time as per treatment. FYM and vermicompost were applied before sowing of seeds along with lime wherever it was required. The required amount of FYM and vermicompost were applied after calculation as per different treatments. The recommended dose of fertilizer is 120:60:60 kg NPK per ha^{-1} was applied through Urea, SSP (Single super phosphate), and MOP (Murate of potash). The total amount of phosphorous and half of nitrogen as well as half of potash were applied as basal dressing before sowing the seeds in the rows. Twenty five days after sowing, half of nitrogen and half of potash was applied as top dressing during hoeing as per the treatment schedule. The soluble fertilizer (19:19:19, N:P:K) was sprayed @ 7.5g/liter as per the treatment schedule. Other recommended package of practices were followed. Observations were taken on different quality parameters like

Germination percentage

Seed germination was determined by the standard germination test using between paper towel method as prescribed by ISTA rules (Anon-1999 b). Hundred seeds of all treatments each were used for germination test. The seed germination count on the 5th day and 8th day for first and final count were recorded respectively and total germination percentage was calculated.

Average seedling length

After harvest of the seeds 100 number of seeds were used for germination in the laboratory. The average length of the germinated seedlings were taken and expressed in centimeter.

Average seedling dry weight

The germinated seedlings were dried inside the oven with optimum temperature and after drying the dry weight was expressed in milligram.

Seedling vigor index

The seedling vigor index is the sum total of all seed attributes that favor stand establishment under varying field conditions. It is calculated by the following formula and expressed in numbers.

Vigor Index-I= Germination% x length of seedling (cm)
Vigor Index -II= Germination% x dry weight of seedling (mg)

Analysis of variance (ANOVA) was carried out on mean values separately for each character adopting standard analysis of variance technique for RBD design (Panse and Sukhatme, 1954) [4].

Results and Discussions

The harvested good quality seeds were selected in counted number for germination test and the data is presented in Table 1. It was found that there was not much significant difference in germination test data conducted in the laboratory. It was observed that highest germination percentage was found with T_8 (92.00) followed by 91.30 in (T_3) and 91.10 in T_2. The lowest germination percentage was found in T_{11} (84.20). It was found that treatments like T_1 (90.20), T_4 (89.60), T_5 (90.00), T_6 (89.20), T_7 (87.20), T_9 (89.20) & T_{10} (85.60) recorded intermediate germination percentage in the laboratory test of the freshly harvested seeds.

The freshly harvested seeds were germinated in the laboratory and the height of the seedling under different treatment is presented in Table 1. It was found that the highest seedling length of 42.80 cm was recorded in T_9, followed by 42.0 cm in T_4 and 41.90 cm in T_1. It was observed that the lowest seedling length of 33.40 cm was found in T_2.There is significant difference in seedling length in T_{11} (36.20) and T_2 (33.40) compared to T_9 (42.80).

The average dry weight of germinated seedling is presented in Table 1. It was found that the dry weight of the seedling was highest in T_7 (0.146g) followed by T_5 (0.134g) and T_1 (0.123g). The lowest dry weight was recorded in T_2 (0.094g). However, there was significant difference among the treatments for average dry weight seedling except T_1 (0.123), T_5 (0.134), T_7 (0.146) of germinated seed as found during investigation.

The vigor index -1 of the seedlings raised from different treatment is presented in Table 1. It was observed that there was no significant differences among the treatments for this character except T_2 (3042.7), T_{10} (3150.1) and T_7 (3191.5). However, the highest vigour index-1 was recorded in T_9 (3817.8) and the lowest was with T_2 (3042.7). The other treatments like T_1 (3779.4), T_4 (3763.2), T_8 (3623.5), T_5 (3609), T_3 (3359.8), T_6 (3353.9), T_7 (3191.5), T_{10} (3150.1) and T_{11} (3048) recorded intermediate value.

The vigour index–II as calculated from dry seed weight of seedling is presented in Table 1. It was found that there was significant variation among the treatments for this character. The highest vigour index-II was recorded with T_7 (12731) and the lowest with T_2 (8563). Except T_5 (12060) and T_7 (12731) other treatments like T_2 (8563), T_{11} (8756), T_3 (8856), T_8 (8943), T_4 (9139), T_9 (9366), T_{10} (9587), T_6 (10258) and T_1 (11095) were found significantly different.

After collection of seed they were allowed to germinate in the laboratory under paper towel method immediately to record the germination percentage of seed and it was observed that only T_{11} recorded significant difference in germination. But in other treatments the germination percentage was not significantly influenced. The average seedling length and average seedling dry weight did not varied significantly. However there were significant differences in vigor index-1 and vigor index-II among the treatments. This type of observation was also reported by Nawalagatti *et al.* (2009) [3], Ramana *et al.* (2011) [5], Kumar and Pandita (2016) [2] earlier. During the experiment application of foliar spraying of fertilizer did not produced any significant effect because in those treatments the amount of total nutrient requirement was not met from different combination. Application of lime in different treatments produced good result indicating that soil test based treatments were good for production of more quality yield in French bean.

Table 1: Seed quality parameters of French bean crop as influenced by different treatments

Treatments		Germination %	Average seedling length (cm)	Average seedling dry weight (mg)	Vigour Idex-1	Vigour Idex-2
T1	RDF	90.20(9.49)	41.90	3779.4	11095	0.123
T2	RDF+ Lime	91.10(9.54)	33.40	3042.7	8563	0.094
T3	75% RDF	91.30(9.55)	36.80	3359.8	8856	0.097
T4	75% RDF+ Lime	89.60(9.46)	42.00	3763.2	9139	0.102
T5	75% RDF+25% FYM	90.00(9.48)	40.10	3609	12060	0.134
T6	75% RDF+25% FYM+ Lime	89.20(9.44)	37.60	3353.9	10258	0.115
T7	75% RDF+25% Vermicompost	87.20(9.33)	36.60	3191.5	12731	0.146
T8	75% RDF+25%Vermicompost + Lime	92.20(9.60)	39.30	3623.5	8943	0.097
T9	75% RDF+12.5%Vermicompost +12.5% FYM+ Lime	89.20(9.44)	42.80	3817.8	9366	0.105
T10	50% RDF+25%FYM + 2 Foliar spray (19:19:19)	85.60(9.24)	36.80	3150.1	9587	0.112
T11	50% RDF+25%Vermicompost + 2 Foliar spray (19:19:19)	84.20(9.17)	36.20	3048	8756	0.104
SE (m) ±		0.14	2.12	0.01	184.15	546.48
CD5%		0.41	6.26	0.03	543.18	1611.91
CV%		2.56	9.54	14.38	9.30	9.52

Figures in the parentheses are transformed angular value

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