Original Research Article

Seed yield, quality and economics of alfalfa seed production as influenced by INM during *kharif* season under southern dry zone of Karnataka

ABSTRACT

The field experiment was carried out at the farm field of Krishi Vigyan Kendra, Konehalli, Tiptur taluk of Tumkuru district under southern dry zone of Karnataka during *Kharif* seasons 2017-18 on seed yield, quality and economics of alfalfa seed production as influenced by integrated nutrient management. The nine treatments and four replication were laid out with Randomized complete block design (RCBD). The results of experiments revealed that the plants supplied with of 50 % RDF + 25 % N through vermicompost + *Rhizobium* + PSB + VAM was resulted highest fresh herb yield at first harvest of herb (160.65q q/ha), herb yield after harvest of seeds (187.50q/ha), early flowering (27.00days), 50% flowering (35.00 days), pod initiation (48.50days), pod maturation (73.05days) were recorded during *Kharif* seasons, while least fresh herb yield, delayed flowering, pod initiation, pod maturation were recorded with application of 10 t/ha FYM + 100 % N through FYM.

The maximum pod (56.78 %), number of pods (228.75/pl), pod yield (19.90/pl), pod length (6.25 mm), pod weight (87.61 mg), seed (56.50 %), number of seeds (5.50/pod), test weight (3.33g), seed yield per hectare (223.38kg/ha) and highest net return per hectare during *Kharif*season were recorded with 50 % RDF + 25 % N through vermicompost + *Rhizobium* + PSB + VAM. while, minimum pod and seed characters,seed yield and net return per hectare were recorded with application of 10 t/ha FYM + 100 % N through FYM. Therefore, application of 50 % RDF + 25 % N through vermicompost + *Rhizobium* + PSB + VAMmay be recommended for commercial seed productionin Alfalfa during *kharif* season under southern dry zone of Karnataka.

Keywords: Alfalfa, INM, Kharif, nutrient, PSB, *Rhizobium*, seed and yield

1. INTRODUCTION

Alfalfa (*Medicago sativa* L.) is fodder crops of India, belongs to the family Fabaceae (Leguminaceae) and growing as annual as well as perennial crops with supply of green fodder continuously with 2-3 years from the same field, it is called as '*Queen of the fodder crops*'. It was introduced into Indiain 1900 from North-West [1] and cultivated in Uttar Pradesh, Punjab, Gujarat, Haryana, Tamil Nadu, Maharashtra and Karnataka are major growing state in the country. It is growing approximately one million hectare of area and produced60-130 tonnes of green fodder per hector per year with 186 - 280 kg/ha of seed yield in India. it is locally known as 'Kuduremasale' in Karnataka.

The Nutritive content of palatable fodder about 13.3 - 26.6% crude protein, calcium (0.92 – 2.9 %), phosphorus (0.14 – 0.66 %), carotene (9.27 mg/ 100g), fibre (20 -30 %) and vitamin A and C [4].It also containstachydrine as medicinal alkaloid and used for of digestive, laxative, diuretic and treating against for blood pressure, arthritis, hair loss, acidityand dropsy. The soil health and environment are deterioration due to continuous use of chemical fertilizers.Which can be preventing by using the judicious combination of different sources of nutrients such as use of organic manures and bio-fertilizers along with balanced inorganic fertilizers is one of the eco-friendly approaches, which can be enhancing the productivity and sustainability [13]. By considering the importance of crop and role of integrated nutrient

management, the experiment wasconducted to study theseed yield, quality and economics of alfalfa seed production as influenced by INM during *kharif* season

2. MATERIALS AND METHOD

The field experiment was carried out at the farm field of Krishi Vigyan Kendra, Konehalli, Tiptur taluk of Tumkuru district under southern dry zone of Karnataka during *Kharif* seasons 2017-18 on seed yield, quality and economics of alfalfa seed production as influenced by integrated nutrient management. The nine treatments and four replication were laid out with Randomized complete block design (RCBD). Plots were prepared with size of 4.32sq.m (2.4 m x 1.8 m) area of red sandy loam soil. Alfalfa seeds of T-9 variety were treated with *Rhizobium meliloti* bio-fertilizers, applied recommended dose of fertilizers and organic manures with bio-fertilizers *viz., Phosporoussolubalizingbacteris (PSB) and vascular arabascularmycorhiza (VAM)* as per treatments.The seeds were sown during *kharif* season with 30 cm x 15 cm spacing.

Treatment details

T_1 : RDF (25:50:25 kg NPK/ha + 10 t/ha FYM)
T_2 : 75% RDF + 25% N through FYM
T_3 :75% RDF + 25% N through Vermicompost
T_4 :75% RDF + 25% N through Poultry manure
T_5 : 50% RDF + 25% N through FYM + Rhizobium + PSB+VAM
T_6 :50% RDF + 25% N through Vermicompost+ Rhizobium + PSB+VAM
T_7 :50% RDF + 25% N through Poultry manure+ Rhizobium + PSB+VAM
T_8 : RDF + *Rhizobium* + PSB+VAM
T_9 : 10 t/ha FYM + 100% N through FYM

Table 1: Analysis of Poultry manure, Vermi-compost and Farm yard manure for NPK content before conducting the experiment

Organic manures	N content (%)	P_2O_5 content (%)	K_2Ocontent (%)
Poultry manure	2.10	1.35	1.76
Vermicompost	1.60	0.86	0.98
Farm yard manure	0.95	0.62	0.75

Thefirst crop was harvested at 60 days after sowing and allowed it for further growth, flowering and to reach physiological maturity stage for obtaining the seeds. Theobservations on herb and seed yield were recorded using five plants per plot. These five plants were randomly selected by avoiding the border plants and labelled for recording the observations at harvest stage.. The recorded data were analysedby suitable statistical analysis as per the procedure outlined by [14].. The results were compared at 5 per cent probability using Fischer's test.

Benefit cost ratio (B:C ratio) :The benefit cost ratio was calculated by using the below mentioned formula

$$\text{B:C ratio} = \frac{\text{Gross income (Rs. ha}^{-1}\text{)}}{\text{Total cost of cultivation (Rs. ha}^{-1}\text{)}}$$

3. RESULTS AND DISCUSSION

3.1 Fresh weight of plants and herb yield of Alfalfa affected by INM during *kharif* season

The fresh weight of plant, herb yield/plot and herb yield/hawere recorded during *kharif* season at first harvest and herb yieldafter harvest of seedsare presented in Table 2.The plants supplied with 50 % RDF + 25 % N through vermicompost + *Rhizobium* + PSB + VAM during *kharif* season wasrecorded maximum fresh weight (133.11g/pl &121.49g/pl), fresh herb yield (3.47kg/plot&4.05kg/plot) and fresh herb yield (160.65q/ha&187.50q/ha) at first harvest of herb and herb yield after harvest of seeds respectively, which was *at par* with the plants supplied 50 % RDF + 25 % N through poultry manure + *Rhizobium* + PSB + VAM. Whereas application of10 t/ha FYM + 100 % N through FYM during *kharif* season were recorded leastfresh weight/plant, fresh herb yield/plot and fresh herb yield/ha at first harvest of herb and herb yield after harvest of seeds.

The highestfresh weight of plant and fresh herb yield might be due to that, vermin-compost is known to produce favourable effect on chemical, biological and physical factors in soil, that determines productivity and fertility status of soil and supply the nutrients in their available form, enhance the microbial population and provides sufficient energy for them to remain active[15]. It also provides both the vital macro-nutrient andmicro-nutrients such as N, P, K, Ca, Mg, besides, *Rhizobium* has been increased the availability of N and helped in the synthesis of tryptophan as resulting obtained maximum herb yield. These results are in agreement with[20] in alfalfa, [9, 18, 8]in ashwagandhaand [9] in davana.

Table 2: Fresh weight of plants and herb yield of Alfalfa affected by INM during *kharif* season

Treatment	Fresh plant weight (g)		Fresh herb yield / plot (kg)		Fresh herb yield / hectare (q)		
	1st Harvest of herb	Herb weight after harvest of seeds	1st Harvest of herb	Herb yield after harvest of seeds	1st Harvest of herb	Herb yield after harvest of seeds	Cumulative herb yield
T_1	115.96	106.08	3.34	3.93	154.63	181.94	336.57
T_2	103.37	96.58	3.23	3.81	149.54	176.39	325.93
T_3	112.15	102.85	3.30	3.89	152.78	180.09	332.87
T_4	110.15	100.06	3.27	3.87	151.39	179.17	330.56
T_5	124.56	113.50	3.41	3.99	157.87	184.72	342.59
T_6	133.11	121.49	3.47	4.05	160.65	187.50	348.15
T_7	129.40	116.97	3.45	4.03	159.72	186.57	346.29
T_8	119.87	109.68	3.38	3.60	156.48	166.67	323.15
T_9	99.02	93.79	3.15	3.76	145.83	174.07	319.90
F- test	*	*	*	*	*	*	*
S.Em±	3.10	2.61	0.017	0.012	1.01	0.81	2.00
CD at 5 %	9.05	7.64	0.05	0.035	2.95	2.36	5.83

3.2 Effect of flowering characters by INM in Alfalfa during *kharif* season

Flowering characters such as days taken for flowering, pod initiation, pod maturation and number of flowers/pl were recorded during *kharif* season are presented in Table 3. The plants supplied with 50 % RDF + 25 % N through vermicompost + *Rhizobium* + PSB + VAM during *kharif* season was recorded in early flowering (27.00days), 50% flowering (35.00days), pod initiation (48.50days), pod maturation (73.05days) and highest number of flowers per plant (405.00) were recorded, which was *on par* withthe application of 50 % RDF + 25 % N through poultry manure + *Rhizobium* + PSB + VAM in pod length. Whereas, application of 10 t/ha FYM + 100 % N through FYM during *kharif* season were recorded in delayed flowering, 50% flowering, pod initiation, pod maturation and least number of flowers.

This might be due to the integrated application ofinorganic fertilizers and organic manurealong with biofertilizers showing similar effect of growth regulators andprovide in better uptake of nutrients by the plants as a resulted in better reproductive growth of the plants. The similar reports were found with[6] in Alfalfa, [12] in peppermint, [16] in Kalmegh, [2, 5] in chamomile.

Table 3:Effect of flowering characters by INM in Alfalfa during *kharif* season.

Treatment	No. of days for flowering	No. of days for 50% flowering	No. of flowers/ plant	No. of days for pod initiation	No. of days for pod maturation
T_1	28.55	36.10	386.50	50.13	75.30
T_2	29.13	37.85	379.25	52.25	77.63
T_3	28.60	36.10	385.75	50.13	75.35
T_4	29.00	37.20	382.50	51.75	76.03
T_5	27.55	35.60	396.63	49.10	74.28
T_6	27.00	35.00	405.00	48.50	73.05
T_7	27.10	35.50	399.25	48.75	73.75
T_8	27.75	35.80	389.63	49.38	74.38
T_9	29.38	38.00	376.00	53.25	78.25
F- test	*	*	*	*	*
S.Em±	0.15	0.18	2.78	0.12	0.38
CD at 5 %	0.44	0.54	8.14	0.34	1.12

3.3 Effect of pod quality by INM in Alfalfa during *kharif* season

The pod quality such as pod set per cent, number of pods/plant, number of filled pods, number of seeds/pod, pod yield, pod weight and pod length were recordedduring *kharif* season are presented in Table 4. The application of 50 % RDF + 25 % N through vermicompost + *Rhizobium* + PSB + VAM during *kharif* season were recorded maximum pod set per cent (56.78%), number of pods (228.75/pl), number of filled pods (129.25/pl), pod yield (19.90/pl), pod weight (87.61mg) and pod length (6.25mm). Whereas, application of 10 t/ha FYM + 100 % N through FYMduring *kharif* season were recorded with minimum pod set per cent, number of pods/plant, number of filled pods/plant, pod yield/plant, pod weight and pod length. The good podquality could be due to application of *Rhizobium*, PSB and VAM enhances vegetative growth, better of photosyntheticand metabolites as resulted in early flowering, pod initiation and which improved the pod characters. The results are similar with the works of [7] in Ambrette.

Table 4: Effect of pod quality by INM in Alfalfa during *kharif* season

Treatment	Pod set (%)	No. of pods per plant	No. of filled pods per plant	Pod yield per plant (g)	Pod length (mm)	Pod weight (mg)
T_1	54.98	212.50	111.50	18.02	5.90	85.38
T_2	53.92	204.50	101.50	16.95	5.63	84.35
T_3	55.02	211.95	111.50	18.00	5.85	85.40
T_4	54.58	208.75	106.55	17.56	5.80	85.25
T_5	56.16	222.25	121.75	19.10	6.00	86.15
T_6	56.78	228.75	129.25	19.90	6.25	87.61
T_7	56.43	225.50	127.50	19.50	6.15	86.03
T_8	56.14	220.00	119.25	18.54	5.98	85.95
T_9	53.66	201.75	98.00	16.58	5.58	83.75
F- test	*	*	*	*	*	*
S.Em±	0.22	2.12	2.10	0.25	0.07	0.41
CD at 5 %	0.64	6.21	6.13	0.73	0.22	1.25

3.4 Effect of seed characters andseed yield by INM in Alfalfa during *kharif* season

The Effect of seed characters and seed yield by INM during *kharif* season are presented in Table 5. The plants supplied with 50 % RDF + 25 % N through vermicompost + *Rhizobium* + PSB + VAM during *kharif* season wasrecorded maximum seed set per cent (56.50%), number of seeds (5.50/pod), test weight (3.33g) and seed yield (2.07g/pl, 48.25g/plot&223.38kg/ha). Whereas,application of 10 t/ha FYM + 100 % N through FYM during *kharif* season was recordedminimum seed set per cent, number of seeds/pod, test weight, seed yield.This might be due to attributed to adequate availability of nutrients sources at different growth stages through the integrated application of inorganic, organic and bio-fertilizers and sequential metamorphosis from source to sink. The similar results are findings with [17] in isabgol and alsoincreased uptake of nitrogen by *rhizobium*fixation of atmospheric nitrogen. Besides, the optimum supply of nutrient could have helped in increased plant metabolic activity and source to sink relationship, thus, higher the yield by more number of seeds. Similar results were found with [3]in Ashwagandha.

Table 5: Effect of seed characters and seed yield by INM in Alfalfa during *kharif* season

Treatment	Seed set per cent	No. of seeds per pod	Test weight (g)	Seed yield per plant (g/pl)	Seed yield per plot (g/plot)	Seed yield per hectore (kg/ha)
T_1	52.47	4.70	3.16	1.95	43.63	201.99
T_2	49.63	4.45	3.10	1.92	42.10	194.06
T_3	52.61	4.71	3.14	1.95	43.53	201.34
T_4	51.04	4.65	3.11	1.94	42.38	196.20
T_5	54.78	5.20	3.20	2.00	46.25	214.12
T_6	56.50	5.50	3.33	2.07	48.25	223.38

T_7	56.04	5.38	3.24	2.03	47.00	217.59
T_8	54.20	4.98	3.18	1.97	45.75	211.80
T_9	48.57	4.35	3.09	1.91	41.38	191.57
F- test	*	*	*	*	*	*
S.Em±	0.24	0.10	0.42	0.02	0.64	2.75
CD at 5 %	0.70	0.29	NS	0.06	1.87	8.03

3.5 Effect of integrated nutrient management on economics of seed production in Alfalfa during *kharif* season

The economics of seed production in Alfalfa during *kharif* season are presented in Table 6. The plants supplied with 50 % RDF + 25 % N through vermicompost + *Rhizobium* + PSB + VAM during *kharif*seasonwas obtained highest net return (Rs. 65,763/ha) andobtained the maximumcost benefitratio (2.12)during *kharif* season with the application of 50 % RDF + 25 % N through poultry manure + *Rhizobium* + PSB + VAM. Whereas, the lowestnet return (Rs.51,824/ha) and B:C ratio (1.92) was obtained with the application of 10 t/ha FYM + 100 % N through FYM during *kharif* season. The highest net return and B:C ratio in seed production could be due to enhancement of growth and development by supplying of integrated nutrients to meet the required demand of the crop till physiological maturity as a resulted in increased seed yield. Similar reports were found by [10, 11] in alfalfa.

Table 6: Effect of INM on economics of seed production in Alfalfa during *kharif* season

Treatment	Economics of seed production during *kharif*season (Rs./ha)			
	Gross return	Cost of cultivation	Net return	B:C ratio
T_1	114090	57199	56891	1.990
T_2	109759	57063	52696	1.930
T_3	113520	58360	55160	1.940
T_4	110998	56987	54011	1.950
T_5	120034	57558	62476	2.080
T_6	124618	58855	65763	2.117
T_7	121873	57482	64391	2.120
T_8	118782	58487	60295	2.030
T_9	108081	56257	51824	1.920

4. CONCLUSION

The study on seed yield, quality and economics of alfalfa seed production as influenced by INM during *kharif* season under southern dry zone of Karnataka revealed, that, the application of 50 % RDF + 25 % N through vermicompost + *Rhizobium* + PSB + VAM has recorded the maximum seed yield, good quality and highest profit in seed production during *kharif* season. Therefore, 50 % RDF + 25 % N through vermicompost + *Rhizobium* + PSB + VAMmay be recommended for commercial seed productionin Alfalfa during *kharif* season under southern dry zone of Karnataka

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Lucerne crop after I harvest

General view of Lucerne experiment during *kharif season*


T_6 R_2


T_6 R_2


T_6 R_2


T1
T2
T3
T4
T5
T6
T7
T8
T9

Fig 1.Harvesting stage of seeds