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Effects of Drip Fertigation Levels on Yield and Nutrient Uptake of Bushbean (Lablab Purpurium Var. Typical L.)

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ABSTRACT

The experiment conducted at Water Technology Centre during rabi -2009-10 .Experiment consisted of four irrigation with three fertigation levels. Results revealed drip irrigation scheduling irrigation at 100 % Epan realized higher green pod yield (3556 kg ha-1) which was 9.5% and 22% higher than the irrigation scheduling at 80% and 60% Epan,. However, the increase in the yield with 100 kg ha-1 N and K was to the tune of 14 and 21 % than application of 50 kg N + 50 kg K2O ha-1 and no fertilizer application, respectively .Total nutrient uptake of N,P and K was higher with drip irrigation scheduling at 100% E pan when compared to other irrigation levels. However, application of optimum dose of fertilizers 100: 100 kg ha-1 N and K through drip resulted in maximum uptake of nutrients at all the stages at 30,60 and 90 DAS compare to other fertigation levels.

KEYWORDS : Fertigation, Irrigation Levels, Yield and Nutrient uptake

INTRODUCTION

Bush bean (*Lablab purpuriem* var. typical L.) is an important shy nodular high value crop (Hegde and Srinivas, 1989. The lablab bean is one of the most ancient among the cultivated plants. The crop is multipurpose since it can be used as pulse, vegetable and for forage. The crop is grown for its green pods while the dry seeds are used in various vegetable preparations. Bushbean belonging to the family Fabaceae, It starts fruting in winter and continues indeterminately in spring (Shrivashankar and Kulkarni, 1989). Lablab can be grown in tropical and sub tropical regions but susceptible to frost and very high temperature, and thrive in a wide range of soils. Nutritive value generally good although crude protein, mineral content and digestibility can be increased by providing optimal phosphorus (P), sulphur (S) and molybdenum (Mo). The crop is being grown widely under lift irrigation around Hyderabad in Rangareddy, Medak, Karimnagar and Nalgonda districts of Andhra Pradesh during winter or summer. Drip irrigation calls for complete fertigation schedules, thus providing adequate nutrients to plants (Goldberg et al., 1971). Fertilizers are costly inputs and efficient use of these costly inputs not only reduces cost of cultivation and improves the quality, yield but also reduces the ground water pollution when given at root zone through irrigation. Considering the importance of inorganic N and K fertilizer, through drip system the present investigation was carried out with an objective of improving in quantity and quality of produce.

MATERIALS AND METHODS

The field experiment was conducted at WTC, College of Agriculture, Rajendranagar, Hyderabad during *rabi* 2009 .The soil was sandy clay loam in texture, ideal in bulk density (1.2 g cc), moderately rapid in saturated hydraulic conductivity (8.2 cm h^{-1}) with field capacity of 19.4 %, permanent wilting point of 7.4 % and available water capacity of 12%, slightly alkaline in reaction (pH-7.8), non saline(0.38 ds m^{-1}), medium in organic carbon (0.65%) with low in available nitrogen (225 kg N ha^{-1}), medium in available phosphorus (32.2 kg P_2O_5 ha^{-1}) and potassium (327.3 kg K_2O ha^{-1}). The experiment was laid out in a strip plot design with three replications. There were 12 treatment combinations compromising four irrigation levels in main plots viz., Surface irrigation at IW/CPE ratio 1.0, Drip irrigation at 100% Epan, Drip irrigation at 80% Epan and Drip irrigation at 60% Epan and three fertigation levels in sub treatments viz., No N & K application, 50 kg N and 50 kg K_2O ha^{-1} and 100 kg N and 100 kg K_2O ha^{-1}. Bush bean was sown as paired row planting at a spacing of 80 cm between pair, 40 cm between rows and plant-to-plant spacing was 15 cm. The laterals of 16 mm diameter were laid at 1.2 m apart with spacing of 50 cm between two inline emitters of 4 L h^{-1} discharge. Under fertigation, N and K_2O were applied in the form of prilled urea (PU) and white muriate of potash (MOP) respectively, while a common dose of phosphorus was applied as basal dose at 100 kg P2O5 ha^{-1} to all treatments through single superphosphate (SSP). During fertigation, entire quantity of PU and MOP was applied in seven equal doses. A total of three green pod pickings were done. Total green pod yield (3 pickings) were recorded and the uptake of N, P and K nutrients were calculated using the following formula and expressed in kg ha^{-1}.

$$\text{Uptake of nutrient (kg ha}^{-1}\text{)} = \frac{\text{Nutrient content (\%)} \times \text{dry matter production (kg ha}^{-1}\text{)}}{100}$$

RESULTS AND DISCUSSION

Green pod yield:

Drip irrigation scheduling at 100% E_{pan} recorded maximum green pod yield (3556 kg ha^{-1}) and was significantly superior to all other drip irrigation and surface irrigation treatments. Regarding the fertigation levels, Significantly higher green pod yield of bush bean (2985 kg ha^{-1}) was recorded with 100 kg N and 100 kg K_2O ha^{-1} and lowest (2476 kg ha^{-1}) with no N and K application .Higher rates of nutrients resulted in better translocation of assimilates from source to sink. The increase in yield under drip irrigation at 100% E_{pan} and 100kg N and 100 kg K_2O through fertigation was due to the performance of all crop growth and yield attributing characters due to better availability of soil moisture and nutrients throughout the crop growth period and also due to accurate and uniform application of the specified and required nutrient must have met with 100 kg N and 100 kg K_2O resulting in improved growth characters dry matter and yield attributes. These finding were in concordance with the findings of Gutal et al., (1989). The increase in yield under 100: 100 kg ha^{-1} N and K_2O through fertigation compared to 50: 50 kg ha^{-1} N & K_2O might be due to the fact that fertigation at higher dose obviously resulted in higher availability of all the three (NPK) major nutrients in the soil solution which led to higher uptake and better translocation of assimilates from source to sink thus in turn increased the yield. Similar linear response to higher doses of fertilizers was obtained in gherkins under drip fertigation by

Sundar Raman et al. (2000).

UPTAKE OF NUTRIENTS

Different drip irrigation levels and N and K fertigation levels exerted significant difference on N P and K uptake at 30, 60 and 90 DAS(Table 1a,1b and 1c) .In all growth stages at30 60 and 90 DAS stages drip scheduled at 100% Epan recorded significantly higher N, P and K uptake followed by 80% E_{pan} 60% Epan and lowest recorded with irrigation given at IW/CPE ratio 1.0 through surface irrigation. With regards to fertigation levels at all the growth stages 30, 60 and 90 DAS the N , P and K uptake in plant increases with increasing the fertilizer levels (N & K) from 0 to 100 kg ha^{-1}. . Significantly higher uptake of nitrogen in plant was observed with application of 100:100 and N and K_20 Kg ha^{-1} when compared to 50 kg N and 50 kg K_2O ha^{-1} and No N & K application. This might be due to efficient utilization of nutrients by plants when fertilizers applied through drip. Significantly higher nutrient uptake at all growth stages (30, 60 and 90 DAS) was observed with drip irrigation scheduling at 100% E pan with application of 100:100 and N and K_20 Kg ha^{-1}. Significantly higher uptake of P in plant was observed with application of 100:100 and N and K Kg ha^{-1} when compared to all other treatments. At 90 DAS drip irrigation scheduling at 100% E pan with application of 100:100 and N and K_20 Kg ha^{-1} recorded significantly higher nutrient uptake and was closely followed by 80% E pan with application of 100:100 and N and K_2O Kg ha^{-1}.). K uptake was significantly higher at 80 % Epan in combination with 100:100 and N and K_2O Kg ha^{-1} fertiliser application in interaction effect. The similar trend was observed at 60 and 90 DAS except the interaction effect. Total uptake of NPK significantly influenced by levels of irrigation, N and K application levels and the interactions found non-significant for P and K. (Table-2). Total N uptake was significantly superior over 80% E_{pan} followed by 60% Epan and the lowest was recorded by irrigation given at IW/CPE ratio 1.0 through surface irrigation. This might be due to maintenance optimum soil moisture for bacterial growth, mineralization and increased availability of nutrients for higher green pod. Higher total P uptake observed at surface irrigation plot and among fertilizers significantly higher P uptake was observed with application of 100:100 and N and K_2O Kg ha^{-1} over the rest of the treatments. The increased uptake may also be due to split application of N and K under drip fertigation that resulted in minimal loss of nutrients thereby making them available continuously to the crop. The application of fertilizer through drip fertigation than soil application produced significantly higher yield reported by Tumbare et al. (1999). Total K uptake were significantly higher with drip irrigation scheduling at 100% E pan with application of 100:100 and N and K_2O Kg ha^{-1}(Table-2). This was due to increasing the dose increased the availability which in turn resulted in higher uptake by plants. Water soluble fertilizers like Multi-K, mono ammonium phosphate used for fertigation was highly soluble in nature and is in easily available form and so the plants were able to absorb the nutrients more efficiently and at higher rate. NPK uptake was the highest with the treatment receiving 100% NPK using urea, MAP and Multi-K reported by Sundar Raman et al. (2000).

Conclusion:

Drip irrigation scheduling at 100% Epan recorded maximum green pod yield (3556 kg ha^{-1}) and was significantly superior to all other drip irrigation. Regarding the fertilizer levels, Significantly higher green pod yield of bush bean (2985 kg ha^{-1}) was recorded with 100:100 N and K_2O kg ha^{1}and lowest (2476 kg ha^{-1}) with no N and K application. The nutrient uptake of bush bean grain was significantly affected by irrigation and fertilizer levels. N, P and K uptake were higher under drip irrigation at 100% E pan with fertigation level of 100:100 N and K_2O kg ha^{-1}.

Table 1a: Effect of irrigation and fertilizer (N and K) levels on N up take of Bush Bean at 30, 60 and 90 DAS

	Fertigation levels											
	30 DAS				60 DAS				90 DAS			
Irrigation levels (I) Epan	N_0K_0	$N_{50}K_{50}$	$N_{100}K_{100}$	Mean	N_0K_0	$N_{50}K_{50}$	$N_{100}K_{100}$	Mean	N_0K_0	$N_{50}K_{50}$	$N_{100}K_{100}$	Mean
S.I.	2.39	2.43	2.55	2.45	10.78	12.67	13.00	12.15	36.09	40.98	46.05	41.04
Drip 100 % E Pan	2.08	2.99	5.09	3.38	14.49	16.97	23.49	18.31	60.98	74.49	85.45	73.64
Drip 80 % E Pan	2.06	2.85	3.69	2.86	11.90	13.34	18.39	14.54	61.65	69.54	73.43	68.21
Drip 60 % E Pan	2.04	2.07	3.55	2.55	11.64	11.99	13.06	12.23	45.09	51.67	57.41	51.39
Mean	2.14	2.58	3.72		12.20	13.74	16.98		36.09	40.98	46.05	
	I	F	I at same F	F at same I	I	F	I at same F	F at same I	I	F	I at same F	F at same I
S.Em $\pm$	0.12	0.11	0.23	0.21	1.74	0.60	1.98	1.34	0.41	0.27	0.60	0.71
C.D (0.05)	0.43	0.35	0.72	0.74	0.49	0.20	0.59	0.86	1.43	0.81	1.94	1.73

Table 1b: Effect of irrigation and fertigation (N and K) levels on P up take of Bush Bean (kg ha^{-1}) at 30, 60 and 90 DAS

Irrigation levels (I) Epan	Fertilizer levels											
	30 DAS				60 DAS				90 DAS			
	N_0K_0	$N_{50}K_{50}$	$N_{100}K_{100}$	Mean	N_0K_0	$N_{50}K_{50}$	$N_{100}K_{100}$	Mean	N_0K_0	$N_{50}K_{50}$	$N_{100}K_{100}$	Mean
S.I.	0.22	0.28	0.29	0.26	1.41	2.65	4.01	2.69	9.92	10.68	11.28	10.62
Drip 100 % E Pan	0.37	0.41	0.48	0.42	4.97	5.23	8.55	6.25	11.44	11.23	13.94	12.20
Drip 80 % E Pan	0.3	0.39	0.34	0.34	3.81	5.21	7.32	5.44	10.56	11.21	13.81	11.86
Drip 60 % E Pan	0.27	0.29	0.3	0.28	2.018	2.51	4.59	3.04	10.9	11.21	11.43	11.18
Mean	0.29	0.34	0.35		3.05	3.9	6.12		9.92	10.68	11.28	
	I	F	I at same F	F at same I	I	F	I at same F	F at same I	I	F	I at same F	F at same I
S.Em $\pm$	0.02	0.01	0.027	0.03	0.17	0.17	0.32	0.3	0.25	0.08	0.28	0.43
C.D (0.05)	0.07	0.03	N.S.	N.S.	0.61	0.5	N.S.	N.S.	0.87	0.25	0.96	0.57

Table 1c: Effect of irrigation and fertigation (N and K) levels on K up take of Bush Bean at 30, 60 and 90 DAS

Irrigation levels (I) Epan	Fertilizer levels											
	30 DAS				60 DAS				90 DAS			
	N_0K_0	$N_{50}K_{50}$	$N_{100}K_{100}$	Mean	N_0K_0	$N_{50}K_{50}$	$N_{100}K_{100}$	Mean	N_0K_0	$N_{50}K_{50}$	$N_{100}K_{100}$	Mean
S.I.	1.25	1.28	1.43	1.32	10.94	11.84	29.98	17.59	30.47	35.19	48.05	37.90
Drip 100 % E Pan	2.22	2.43	4.09	2.91	16.62	38.06	48.62	34.43	32.41	49.29	69.18	50.29
Drip 80 % E Pan	2.14	2.89	4.30	3.11	18.31	38.98	40.64	32.64	29.64	46.08	58.81	44.85
Drip 60 % E Pan	2.10	2.94	3.35	2.79	19.60	29.63	35.22	28.15	27.53	39.63	52.34	39.84
Mean	1.93	2.38	3.29		10.94	11.84	29.98		30.01	42.55	57.10	
	I	F	I at same F	F at same I	I	F	I at same F	F at same I	I	F	I at same F	F at same I
S.Em $\pm$	0.20	0.09	0.25	0.34	0.30	0.23	0.49	0.53	0.48	0.25	0.63	0.83
C.D (0.05)	0.69	0.28	0.83	0.62	1.05	0.70	1.56	1.49	1.67	0.75	2.07	1.63

Table 2 : Effect of irrigation and fertigation (N and K) levels on NPK total up take of Bush Bean

Irrigation levels (I) Epan	Fertigation levels											
	Total N Uptake (Kg ha^{-1})				Total P Uptake (Kg ha^{-1})				Total K Uptake (Kg ha^{-1})			
	N_0K_0	$N_{50}K_{50}$	$N_{100}K_{100}$	Mean	N_0K_0	$N_{50}K_{50}$	$N_{100}K_{100}$	Mean	N_0K_0	$N_{50}K_{50}$	$N_{100}K_{100}$	Mean
S.I.	70.90	75.40	79.60	75.30	16.77	18.30	19.30	18.12	41.00	45.50	46.30	44.27
Drip 100 % E Pan	86.30	93.70	99.00	93.00	16.43	16.00	18.40	16.94	50.20	54.07	56.90	53.72
Drip 80 % E Pan	82.70	80.80	94.80	86.10	14.63	15.13	15.47	15.08	48.17	46.60	54.37	49.71
Drip 60 % E Pan	74.50	78.30	80.20	77.60	15.49	16.03	17.20	16.24	42.67	45.17	46.10	44.64
Mean	78.60	82.10	88.40		15.83	16.37	17.59		45.51	47.83	50.92	
	I	F	I at same F	F at same I	I	F	I at same F	F at same I	I	F	I at same F	F at same I
S.Em $\pm$	1.40	0.80	1.90	2.40	0.30	0.17	0.41	0.52	0.73	0.59	1.21	1.27
C.D (0.05)	4.70	2.50	6.20	5.50	1.04	0.51	N.S.	N.S.	2.52	1.78	N.S.	N.S.

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