



RESEARCH PAPER

Productivity and economics of potato (*Solanum tuberosum*) + frenchbean (*Phaseolus vulgaris*) intercropping system

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Abstract : A field experiment was conducted during *Rabi* 2010-11 to 2012-13 at Vegetable Research Station Kalyanpur, Kanpur (U.P.) in which intercroppings of potato + frenchbean in 1:1, 2:1 and 1:2 row ratios were tested against sole crops of potato and frenchbean. Based on 3 year results, intercropping adversely affected the yield of potato from 30.2 to 68.2 per cent and that of frenchbean from 58.7 to 82.3 per cent. Total productivity in terms of potato equivalent yield was highest of 38.48 t/ha in sole potato which also earned significantly highest of Rs. 151149/ha net return. Among intercroppings, 2:1 row ratio of potato + frenchbean registered higher productivity of 30.76 t/ha potato equivalent yield and Rs. 126619/ha net return. All intercroppings recorded LER value less than one which showed that in present study, intercropping neither proved productive nor profitable compared to sole potato. Further studies are needed in this respect.

Key Words : Potato, Frenchbean, Intercropping, Productivity, Economics

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INTRODUCTION

Potato is the most popular food crop used as vegetable in every household of the country. India is one of the important countries producing about 25 million tones of potato from an area of 1.34 million ha with an average productivity of 18.6 t/ha (Tyagi *et al.*, 2012). Development of photo-insensitive varieties of frenchbean has made it possible to grow this crop during winter season in northern and central plains. The introduction of grain legumes in non-traditional areas and development of their suitable production technology offer great possibilities for increasing the pulse production in India. Frenchbean is a slow growing crop and takes long time for the

canopy to cover the ground. It thus offers a possibility to grow as intercrop with other crops, where it utilizes the space and other resources efficiently (Ahlawat, 1998). Earlier studies have shown that potato and frenchbean could successfully be intercropped for higher productivity and monetary returns (Ali and Lal, 1991). Keeping this in view, an experiment was conducted on potato + frenchbean intercropping for higher land use efficiency, productivity and profitability.

MATERIAL AND METHODS

A field experiment was conducted at Vegetable

Research Station Kalyanpur of C.S. Azad University of Agriculture and Technology, Kanpur (U.P.) during *Rabi* season of 2010-11, 2011-12 and 2012-13. The soil was a sandy loam with 7.8 pH. It was low in organic carbon (0.40%), total nitrogen (0.037 %), medium in available P (16.8 kg/ha) and available K (197 kg/ha). There were total five treatments *viz.*, sole potato, sole frenchbean, potato + frenchbean 1:1 row ratio, potato + frenchbean 2:1 row ratio and potato + frenchbean 1:2 row ratio, which were tested in Randomized Block Design replicated four times. Sole potato was planted in 60cm spaced rows while frenchbean sole was sown in rows 30 cm apart. Plant spacing was kept 20 cm in both component crops under both systems. Intercropping of frenchbean was done by replacing potato rows. Variety 'Kufri Bahar' of potato and 'Azad Rajmah-1' of frenchbean were used in the experiment. Sole potato crop was fertilized with 180 kg N + 80 kg P₂O₅ + 100 kg K₂O/ha while sole frenchbean was fertilized @ 120 kg N + 80 kg P₂O₅ + 60 kg K₂O/ha. Both crops in intercropping treatments were fertilized on the basis of actual area sown under different crops. The planting of potato was done on 25-28 October and harvesting on 20-25 February, whereas, frenchbean was sown during first week of November and picking of pods was completed till mid February in different years. The crop of frenchbean was grown for green pods use in vegetable. Experimental crops were raised as per recommended package of practices in irrigated condition except treatments.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Crop yield :

Sole stand of potato recorded significantly higher yield than intercropped stands in all the three seasons (Table 1). The magnitude of reduction, however, varied from season to season and also due to intercropping treatments. Similarly, the yield of frenchbean was recorded highest in sole stand, which also reduced significantly in intercropping treatments during all seasons. This could be attributed to reduced plant density per unit area in intercropping systems. Pooled results indicated that potato yield reduced in intercropping with frenchbean in 1:1, 2:1 and 1:2 row ratios compared to

sole potato by the margins of 18.47, 11.61 and 26.24 t/ha or 48.0, 30.2 and 68.2 per cent against reduction in plant stand per unit area by 50.0, 33.3 and 66.7 per cent, respectively. These data show that yield reduction of potato in 1:1 and 2:1 row ratio of intercropping was lesser than reduction in plant stand compared to sole potato, but in 1:2 row ratio of intercropping, potato yield was reduced more than reduction in plant stand. It might be attributed to competition between component crops. In case of frenchbean, yield reductions in 1:1, 2:1 and 1:2 row ratio of potato : frenchbean intercroppings were recorded 4.63, 5.68 and 4.05 t/ha or 67.1, 82.3 and 58.7 per cent against plant stand reductions of 75.0, 83.3 and 66.7 per cent, respectively compared to sole frenchbean in pooled results. These data show that yield reduction in intercropping system was lesser than the reduction in plant stand per unit area compared to sole frenchbean. It might be attributed to availability of more space/row of frenchbean which reduced the competition with potato crop, thus utilized resources more efficiently.

Total productivity :

It was worked out in term of potato equivalent yield. The results of Table 1 showed that sole potato resulted in higher productivity over all intercropping systems in all seasons. It might be attributed to reduction in plant stand of potato per unit area in intercropping systems where replaced row space of potato could not be utilized fully by intercrop frenchbean perhaps due to lesser plant stand than the required in replaced row space as normal row spacing for frenchbean is only 30 cm but here it was provided with 60 cm row spacing, thus some land area gone waste. It was not utilized either by potato or frenchbean. This fact is also proved from the figures of land equivalent ratio (LER) given in Table 1. However, among intercropping treatments, 2:1 row ratio of potato + frenchbean recorded significantly higher potato equivalent yield than other intercroppings. It might be attributed to comparatively higher plant stand of potato per unit area in 2:1 row ratio than in 1:1 or 1:2 row ratio of intercroppings. Almost similar results were observed by Ahlawat (1998) in frenchbean + potato intercropping.

Economics :

Gross return followed the same pattern of productivity. Potato sole registered highest gross income while lowest was obtained from sole frenchbean. Among intercroppings, 2:1 row ratio of potato + frenchbean gave

highest and 1:2 row ratio gave lowest gross income. These are attributed mainly to potato yields which were associated with potato plant stand per unit area in different intercrops. Though selling rates of frenchbean pods were much higher than potato tubers, those could not compensate for much lower yield of frenchbean per unit area in different treatments. Net return values also followed the same pattern of gross return. In

pooled results, sole potato earned significantly highest of Rs. 151149/ha net return which was found Rs. 62324, 58890, 24530 and 95285/ha or 70.2, 63.8, 19.4 and 170.6 per cent higher than the net return obtained from sole frenchbean, 1:1, 2:1 and 1:2 row ratio of potato + frenchbean intercrops, respectively. It might be attributed mainly to gross return values. However, B:C ratio was found out significantly highest

Table 1 : Effect of treatments on economic yield (t/ha) and economics of potato + frenchbean intercropping

Treatments	Yield (t/ha)			LER	Economics (Rs./ha)			
	Potato tubers	French bean green pods	Potato equivalent		Total cost of cultivation	Gross return	Net return	B:C ratio
2010-11								
Sole potato	35.68	–	35.68	1.00	65802	196240	130438	2.98
Sole frenchbean	–	5.20	16.45	1.00	24500	93600	69100	3.82
Potato + FB (1:1)	17.93	1.62	23.06	0.82	72552	127775	55223	1.76
Potato + FB (2:1)	25.17	0.98	28.27	0.89	74152	156075	81923	2.10
Potato + FB (1:2)	11.41	1.96	17.61	0.70	71302	100035	28733	1.40
S.E. ±	0.60	0.39	0.84	–	302	842	756	0.22
C.D. (P=0.05)	1.31	0.86	1.84	–	657	1834	1648	0.48
2011-12								
Sole potato	43.40	–	43.40	1.00	63802	238150	174348	3.73
Sole frenchbean	–	9.54	31.22	1.00	24500	135495	110995	5.53
Potato + FB (1:1)	20.93	3.15	31.24	0.81	50151	174775	124624	3.48
Potato + FB (2:1)	26.05	1.59	31.25	0.77	58950	229675	170725	3.89
Potato + FB (1:2)	12.64	3.22	23.18	0.63	41620	116460	74840	2.79
S.E. ±	0.63	0.24	0.97	–	312	619	555	0.24
C.D. (P=0.05)	1.37	0.53	2.11	–	679	1349	1210	0.53
2012-13								
Sole potato	36.37	–	36.37	1.00	69560	218220	148660	3.13
Sole frenchbean	–	6.16	19.10	1.00	24500	110880	86380	4.52
Potato + FB (1:1)	21.18	2.12	27.75	0.93	68310	165240	96930	2.41
Potato + FB (2:1)	29.40	1.08	32.75	0.98	68630	195840	127210	2.85
Potato + FB (1:2)	12.67	3.21	22.62	0.87	69780	133800	64020	1.91
S.E. ±	0.84	0.15	0.88	–	273	811	694	0.08
C.D. (P=0.05)	1.82	0.33	1.92	–	594	1768	1512	0.18
Pooled								
Sole potato	38.48	–	38.48	1.00	66388	217537	151149	3.28
Sole frenchbean	–	6.90	22.26	1.00	24500	113325	88825	4.63
Potato + FB (1:1)	20.01	2.27	27.35	0.85	63671	155930	92259	2.46
Potato + FB (2:1)	26.87	1.22	30.76	0.88	67244	193863	126619	2.94
Potato + FB (1:2)	12.24	2.85	21.14	0.73	60901	116765	55864	2.01
S.E. ±	0.35	0.14	0.73	–	136	1481	773	0.15
C.D. (P=0.05)	0.69	0.28	1.44	–	266	2902	1516	0.29

of 4.63 in sole frenchbean which might be attributed to much lower cost of frenchbean cultivation compared to other treatments. These results are in accord with Tyagi *et al.* (2012). Similar work related to the present investigation was also carried out by Sahoo and Tarai (2014) on yam and maize, Koppalkar *et al.* (2013) on pigeonpea and ashwagandha, Manjith Kumar *et al.* (2012) on chickpea with various *Rabi* oilseed crops, Vishwanatha *et al.* (2012) on pigeonpea and sunflower and Deore *et al.* (2013) on forage maize and cowpea and the results found were more or less similar to the present findings.

REFERENCES

- Ahlawat, I.P.S. (1998).** Production potential of frenchbean (*Phaseolus vulgaris*) – based intercropping systems in northern plains. *Indian J. Agron.*, **43** (1) : 45-49.
- Ali, M. and Lal, S. (1991).** *Rabi* Rajmash – Potentialities, limitations and technology of production. Technical Bulletin 3, Directorate of Pulses Research, Kanpur, 14-16pp.
- Deore, S.M., Patel, M.R., Patel, P.M., Patel, H.K. and Patel, U.J. (2013).** Production potential of forage maize (*Zea mays* L.) – cowpea (*Vigna unguiculata* L.) intercropping system as influenced by row ratios. *Adv. Res. J. Crop Improv.*, **4** (2) : 110-112.
- Koppalkar, B.G., Pujari, B.T. and Desai, B.K. (2013).** Influence of row proportions on yield and yield components of pigeonpea in intercropping system of pigeonpea [*Cajanus cajan* (L.) Millsp.] and ashwagandha (*Withania somnifera* Dunal). *Internat. J. agric. Sci.*, **9**(1): 100-103.
- Manjith Kumar, B.R., Mansur, Chidanand P., Salimath, P.M. and Vishwanatha, S. (2012).** Evaluation of different intercropping row proportions of chickpea with various *Rabi* oilseed crops under rainfed condition, *Internat. J. Forestry & Crop Improv.*, **3** (2) : 72-75.
- Sahoo, T.R. and Tarai, R.K. (2014).** Effect of chemical fertilizers and mulching on growth, yield and residual soil fertility status under yam-maize intercropping system. *Internat. J. agric. Sci.*, **10** (1): 372-377.
- Tyagi, V.K., Thenua, O.V.S., Kumar, D. and Singh, N. (2012).** Effect of irrigation and cropping system on potato (*Solanum tuberosum*) grown sole or intercropped with frenchbean (*Phaseolus vulgaris*). *Indian J. Agron.*, **57** (4) : 357-361.
- Vishwanatha, S., Anilkumar, S.N., Koppalkar, B.G., Pujari, B.T. and Desai, B.K. (2012).** Effect of fertilizer management on economics and yield advantages of pigeonpea and sunflower intercropping system, *Internat. J. Forestry & Crop Improv.*, **3** (2) : 76-79.

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