

## Productivity and profitability of baby corn (*Zea mays*)-based cropping systems under various nutrient-management practices

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### ABSTRACT

A field experiment was conducted during 2016–17 to 2017–18 at the ICAR-Indian Agricultural Research Institute, New Delhi, to study the productivity and profitability of baby corn (*Zea mays* L.)-based cropping system under various cropping systems with different nutrient-management levels. The experiment was laid out in a split-plot design with 3 baby corn-based cropping systems (CSs) in main plots, viz. CS<sub>1</sub>, rainy season baby corn-winter season baby corn-summer season baby corn (RBc – WBc – SBc); CS<sub>2</sub>, RBc – WBc + vegetable fenugreek (*Trigonella foenum-graecum* L.) – summer season vegetable cowpea [*Vigna unguiculata* (L.) Walp.] (RBc – WBc + VFg – SCp); and CS<sub>3</sub>, RBc – WBc + VFg – summer season sweet corn (RBc – WBc + VFg – SSc), and 5 nutrient-management levels, viz. N<sub>1</sub>, 100% recommended dose of nitrogen (RDN) through urea fertilizer (100% RDN – F); N<sub>2</sub>, 75% RDN – F + 25% RDN through FYM (75% RDN – F + 25% RDN – FYM); N<sub>3</sub>, 75% RDN – F + 25% RDN through vermicompost (75% RDN – F + 25% RDN – VC); N<sub>4</sub>, 75% N % RDN – F + 25% N through leaf compost (75% RDN – F + 25% RDN – LC); and N<sub>5</sub>, microbial consortium of *Rhizobium*/*Azotobacter* + phosphorus-solubilizing bacteria + potassium-solubilizing bacteria (R/Azo + PSB + KSB), in subplots. The yield of different component crops converted and presented in terms baby corn-equivalent yield (BCEY) for better understanding. Among the cropping systems, the BCEY differed from 1.99 to 2.18 Mg/ha during the rainy season. Baby corn CSs intensified with vegetable fenugreek during the winter season, resulted in significantly higher BCEY (2.42–2.52 Mg/ha) with CS<sub>2</sub> and CS<sub>3</sub> than the sole baby corn (CS<sub>1</sub>). Similarly, during the summer season, significantly higher BCEY (3.03–3.07 Mg/ha) was recorded with CS<sub>3</sub>. The cropping system CS<sub>2</sub> recorded significantly lowest BCEY during both the years. The net returns in all CSs during rainy season was not differed significantly. During the winter season, significantly higher net returns (130–142 × 10<sup>3</sup> ₹/ha) were recorded in both the intensified cropping systems (CS<sub>2</sub> and CS<sub>3</sub>) than CS<sub>1</sub> (95–98 × 10<sup>3</sup> ₹/ha). During the summer season, significantly higher net returns (~186 × 10<sup>3</sup> ₹/ha) were recorded in CS<sub>3</sub> than both CSs. Among the nutrient-management levels, significantly higher BCEY and net returns were recorded with 75% RDN – F + 25% RDN – FYM, followed by 75% RDN – F + 25% RDN – VC during both the years.

**Key words:** Baby corn, Crop diversification, Intensified cropping systems, Nutrient-management, Sweet corn

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Maize (*Zea mays* L.) is a crop of the 21<sup>st</sup> century as it has higher yield potential and versatility in growing and uses. It is a very important crop for food and nutritional security for the modern world, as it has multifarious uses, viz. food, feed, fodder, vegetables, and energy. In India, especially in peri-urban agglomeration, maize is taking place by replacing the other non-remunerative crops. Among the specialty corns, baby corn is becoming very popular owing to higher market demand, economic returns, export and huge employment generation potential. Baby corn is an unfertilized, immature dehusked cob, harvested after 1 to 2 days of silking when silks achieve 2–3 cm length and consumed as vegetable or raw. The nutrient-rich property has made it popular among vegetarians of elite

class society. Baby corn also provides green, soft and nutrient-rich palatable fodder for milch animals. Because of its short duration (55–60 days) and market demand, farmers preferred to grow 3 to 4 crops in a year. Moreover, baby corn, being a nutrient-exhaustive crop, responds very well to high fertility levels. Most of its nutrient demand is fulfilled through inorganic nutrient sources. Therefore, baby corn-based mono-cropping and improper nutrient-management practices will not be sustainable in the absence of resource-efficient diversified cropping system with integrated nutrient management. The intensification and replacement of crops in baby corn-based cropping system would be better way to achieve sustainable production. No doubt, growing of baby corn as sole is highly profitable in the short run, but their diversification is an urgent need for sustainable production in the long run. The intercropping of vegetable fenugreek (*Trigonella foenum-graecum* L.) with baby corn during the winter season would enhance profitability and soil health by adding N through biological nitrogen fixation and altering soil microbial activity in rhizosphere. Similarly, replacement of baby corn with sweet corn and cowpea [*Vigna unguiculata* (L.) Walp.] during the summer season could be another way for enhancing the overall productivity of baby corn. Inclusion of legumes in cereal-based cropping systems has also frequently been suggested as a means of increasing soil fertility and agro-ecological resilience for farmers with limited access to nutrient resources (Yadav *et al.*, 2021).

Maize, being a nutrient-intensive crop, responds to higher dose of chemical fertilizers. For getting higher production, farmers of peri-urban areas applying large amount of NPK based straight fertilizers which leads to poor soil health (Joshi *et al.*, 2021). Among the major nutrients, nitrogen is highly soluble and very difficult to manage in soil system. Therefore, proper nitrogen management in cropping systems is the need of hour for sustainable production. Study also confirms that the long-term intensive cropping without addition of organic manures declines soil quality and crop productivity (Sharma *et al.*, 2017). Nitrogen use efficiency can be increase through integrated use of organic and inorganic nutrient sources. Application of organic manures not only supply essential nutrients but also improve the various soil physical, chemical and biological properties (Kumar and Dhar, 2010). Therefore, proper nutrient management strategy by using organic and inorganic nutrient sources needs to be developed for sustaining soil health and productivity. Healthy soil is the fundamental base for achieving the potential yield of intensified baby corn-based cropping system (Yadav *et al.*, 2021). Since, effect of different baby corn-based cropping system and various nutrient managements on productivity and profitability of baby corn have not been tested so far, present

study was carried out to assess the productivity and profitability of baby corn under various cropping systems and nutrient management levels.

## MATERIALS AND METHODS

The field experiment was conducted during the rainy, winter and summer seasons of 2016–17 to 2017–18 at the ICAR-Indian Agricultural Research Institute, New Delhi (28.40° N, 77.12° E, 228.6 m above mean sea-level). The climate of the experimental site is a typical semi-arid and sub-tropical type with hot and dry summer, very cold winter and medium to heavy rains, falls under the agro-climatic zone of 'Trans-Gangatic plains. The mean annual rainfall is ~650 mm, of which 80% is received during June–September and the remaining from October to May. The soil at experimental site was sandy loam with bulk density of 1.55 Mg/m<sup>3</sup>, water-holding capacity of 35.3%, organic carbon of 0.41%, available nitrogen of 160.8 kg/ha, available phosphorus of 12.8 kg/ha, available potassium of 156.8 kg/ha and pH of 7.5.

The experiment was laid out in a split-plot design with 3 baby corn-based cropping systems (CSs) in main plots, viz. rainy season baby corn-winter season baby corn-summer season baby corn (RBc – WBc – SBc); RBc – WBc + vegetable fenugreek-summer vegetable cowpea (RBc – WBc + VFg – SCp); RBc – WBc + VFg – summer season sweet corn (RBc – WBc + VFg – SSc) and 5 nutrient-management levels, viz. N<sub>1</sub>, 100% recommended dose of nitrogen (RDN) through urea fertilizer (100% RDN – F); N<sub>2</sub>, 75% RDN – F + 25% RDN through FYM (75% RDN – F + 25% RDN – FYM); N<sub>3</sub>, 75% RDN – F + 25% RDN through vermicompost (75% RDN – F + 25% RDN – VC); N<sub>4</sub>, 75% N% RDN – F + 25% N through leaf compost (75% RDN – F + 25% RDN – LC); and N<sub>5</sub>, microbial consortium of *Rhizobium*/ *Azotobacter* + phosphorus – solubilizing bacteria + potassium-solubilizing bacteria (R/Azo + PSB + KSB) in subplots. All the treatments were replicated thrice. The N, P and K, average concentrations in FYM, VC and LC used in the study were 0.81, 1.63 and 0.64% N, 0.49, 0.60 and 0.41% P and 0.71, 0.73 and 0.79% K respectively. The required quantity organic sources of nutrients were computed based on their nitrogen concentration and moisture content. The RDN at the rate of 160, 120 and 25 kg/ha for baby corn, sweet corn and cowpea respectively, were used during both the years of study. All the manures were applied ~6 days before sowing of crops and uniformly mixed with soil. The microbial consortium of *Rhizobium leguminosarum* in cowpea and fenugreek, and *Azotobacter chroococcum* in baby corn and sweet corn as nitrogen-fixing microbes, PSB (*Pseudomonas putida* and *Bacillus megaterium*) as phosphorus solubilizers and *Frateuria aurantia* as potassium solubilizers were used in

last treatment ( $N_5$ ). In baby corn and sweet corn, nitrogen through urea was applied into 3 equal splits, viz. at the time of sowing, at knee-high stage (20–25 days after sowing) and at pre-tasseling stage (35–40 days after sowing), while, full dose of nitrogen was applied at the time of sowing in cowpea. Vegetable fenugreek was intercropped with baby corn during the winter and no additional nutrients were applied. The seed of baby corn cultivar 'Syngenta G-5414' (@ 25 kg/ha) at 60 cm × 15 cm, sweet corn cultivar 'Madhuri' (@ 10 kg/ha) at 60 cm × 30 cm and cowpea cultivar 'Pusa Anmol' (@ 25 kg/ha) at 60 cm × 30 cm row-to-plant spacing were sown in respective seasons. Pusa Early Bunching cultivar (@ 15 kg/ha seed) was used for vegetable fenugreek.

Excess plants of baby corn, sweet corn, and cowpea were thinned, and gaps were filled with the sowing of treated seeds 2–3 weeks after sowing. Agronomic interventions for timely irrigation and weed management were applied for better crop growth throughout the growing season. The baby cobs were harvested after 1–2 days of silk emergence, when silk length reached 1–2 cm. Harvest duration of the baby corn varied in seasons, it took ~55, 70, and 90 days for harvest during rainy, summer and winter season respectively. Similarly, sweet corn was harvested at the milking stage, ~80 days after sowing. The green pod of cowpea was harvested ~60 days after sowing; a total of 4 pickings were taken. The picking of vegetable fenugreek was started ~50 days after sowing.

The yields of component crops were recorded from net plot and represented as Mg/ha. Just after the last picking, green plants from net plots were harvested and the fresh weight was recorded. The green fodder yield was computed and expressed as Mg/ha. The yield of component crops of the rainy, summer and winter season was converted into baby corn-equivalent yield (BCEY) as:

$$\text{BCEY} = \frac{\text{Yield of component crops} \times \text{price of component crops}}{\text{Price of baby corn}}$$

In BCEY, the yield of component crops was converted into main crop (baby corn) yield to allow better comparison among diversified cropping systems. Here, the yield of baby corn is considered as yield of baby cobs without husks. Similarly, net returns of various component crops during various seasons were computed by deducting of cost of cultivation from gross returns as:

$$\text{Net returns (₹/ha)} = \text{Gross returns (₹/ha)} - \text{cost of cultivation (₹/ha)}$$

Data were analysed statistically through Microsoft Excel and SSCNARS system. Analysis of variance (ANOVA) for split-plot design was done as per the procedure given by Gomez and Gomez (1984). The significant differences between treatments were compared with the critical difference (CD) at 5% level of probability.

## RESULTS AND DISCUSSION

### *Yield of component crops*

*Rainy season (baby corn)*; Baby corn and green fodder yields were found non-significant under different cropping systems; however, differed significantly under different nutrient-management levels during both the seasons (Table 1). The highest baby corn (1.74 Mg/ha) and green fodder yields (24.5 Mg/ha) were recorded with 75% RDN – F + 25% RDN-VC during the first seasons, whereas the highest baby corn (1.89 Mg/ha) and green fodder yield (27.78 Mg/ha) were observed with 75% RDN-F + 25% RDN-FYM during the second season; both the treatments remained at par with each other and significantly higher than to 100% RDN-F. Significantly lowest baby corn and green fodder yields were observed with R/Azo + PSB + KSB. It seems that higher mineralization rate and faster-nitrogen supplying capacity of VC than to FYM and LC surpass the yield performance of baby corn during the initial period. However, due to bulky nature, residual fertility, slow and steady nutrient release pattern of FYM resulted in better yield performance of component crops after the first season. The findings support the results of Kumar and Dhar (2010).

The BCEY of rainy season was found non-significant due to growing of sole baby corn in all the cropping systems, whereas the variation among the nutrient-management levels during both seasons was significant (Table 2). Among the nutrient-managements, 25% substitution of RDN through FYM and VC resulted in significantly ( $P=0.05$ ) higher BCEY than that of 100% RDN-F during both the seasons. The BCEY under 75% RDN-F + 25% RDN-LC was at par during the first season and significantly higher during the second season compared to 100% RDN-F. These findings are in close proximity with the findings of Preetham *et al.*, (2021). Among both the seasons, higher BCEY was observed in the second season across the nutrient-management levels except R/Azo + PSB + KSB, where decrement was observed due to nutrient mining. The highest increment was observed with 75% RDN-F + 25% RDN-FYM owing to bulky nature, residual fertility, slow and steady mineralization of FYM.

*Winter season (baby corn, vegetable fenugreek)*; Vegetable fenugreek was intercropped with baby corn in RBc-WBc + VFg-SCp and RBc-WBc + VFg-SSc cropping systems during the winter season. Baby corn and green fodder yield of winter season were lesser than that of the rainy season, irrespective of the seasons, cropping system, and nutrient-management levels. The yield of baby corn among the different cropping systems were found non-significant. However, fenugreek when intercropped in baby corn cropping system gave higher BCEY than sole baby corn in the winter season. The maximum baby corn yield (1.44 and

**Table 1.** Effect of cropping systems and nutrient-management levels on yield of component crops

Treatment	Rainy season						Winter season						Summer season						
	Baby corn yield (Mg/ha)		Green fodder		Baby corn yield (Mg/ha)		Green fodder		Fenugreek		Baby corn yield (Mg/ha)		Green fodder		Cowpea yield (Mg/ha)		Sweet corn yield (Mg/ha)		
	Cob without husk	without husk	Cob without husk	without husk	Cob without husk	without husk	Leaf yield (Mg/ha)	without husk	without husk	without husk	Cob without husk	without husk	without husk	without husk	Green pods	Stover	Green cob yield	Green fodder yield	
2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2018	
<i>Cropping systems</i>																			
RbC-WBc-SBc	1.59	1.65	21.28	23.84	1.44	1.49	19.87	21.40	-	-	1.39	1.44	19.47	19.88	-	-	-	-	-
RbC-WBc+VFg-SCp	1.57	1.72	21.57	24.63	1.37	1.43	19.27	19.85	1.70	1.83	-	-	-	-	3.11	3.57	5.88	6.16	-
RbC-WBc+VFg-SSc	1.59	1.62	21.25	23.74	1.36	1.37	18.53	20.59	1.58	1.65	-	-	-	-	-	-	7.31	7.40	18.43
SEM±	0.02	0.04	0.76	0.48	0.08	0.04	0.43	0.36	-	-	-	-	-	-	-	-	-	-	-
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	-	-	-	-	-	-	-	-	-	-	-
<i>Nutrient-management levels</i>																			
100% RDN-F	1.62	1.65	21.73	24.20	1.36	1.41	18.81	19.82	1.61	1.77	1.41	1.53	19.08	20.97	2.90	3.45	5.73	6.03	7.52
75% RDN-F + 25% RDN-FYM	1.73	1.89	23.20	27.78	1.67	1.72	22.62	25.34	1.70	1.85	1.59	1.66	21.79	23.05	3.65	4.29	6.73	7.17	8.33
75% RDN-F + 25% RDN-VC	1.74	1.84	24.53	27.08	1.60	1.69	21.13	23.47	1.69	1.81	1.55	1.62	21.70	21.81	3.36	4.06	6.53	6.77	8.04
75% RDN-F + 25% RDN-LC	1.67	1.82	22.17	26.71	1.42	1.60	20.63	23.16	1.65	1.80	1.48	1.54	21.22	22.09	3.27	3.89	5.93	6.41	7.83
AZ/R + PSB + KSB	1.15	1.11	15.21	14.59	0.89	0.74	12.91	11.28	1.54	1.48	0.95	0.86	13.54	11.49	2.35	2.18	4.47	4.44	5.28
SEM±	0.03	0.02	0.44	0.50	0.04	0.04	0.57	0.48	-	-	-	-	-	-	-	-	-	-	-
CD (P=0.05)	0.08	0.07	1.29	1.46	0.12	0.13	1.67	1.41	-	-	-	-	-	-	-	-	-	-	-

RbC, rainy season baby corn; WBc, winter season baby corn; SBc, summer season baby corn; VFg, vegetable fenugreek; SCp, summer season vegetable cowpea; SSc, summer season sweet corn; RDN-F, recommended dose of nitrogen through fertilizer (urea); FYM, farmyard manure; VC, vermicompost; AZ/R + PSB + KSB, *Azotobacter/Rhizobium* + phosphorus-solubilizing bacteria + potassium-solubilizing bacteria

1.49 Mg/ha) and green fodder yield (19.87 and 21.40 Mg/ha), over the years were recorded with RbC + WBc + SBc cropping system (Table 1). This might be because of competitive effect of fenugreek intercropping on the baby corn at initial growth and development stage.

Among the nutrient-management levels, the significantly highest baby corn (1.67 and 1.72 Mg/ha) and green fodder yields (22.62 and 25.34 Mg/ha), during the both seasons, were recorded with 75% RDN-F + 25% RDN-FYM, followed by 75% RDN-F + 25% RDN-VC compared to 100% RDN-F. Significantly lowest baby corn and green fodder yield were observed with R/Azo + PSB + KSB. The yield of vegetable fenugreek among the nutrient-management levels was recorded, the highest fenugreek leaf yield (1.70 and 1.85 Mg/ha) over the years were recorded with 75% RDN-F + 25% RDN-FYM, followed by 75% RDN-F + 25% RDN-VC (Table 1). Treatment with microbial consortium, viz. R/Azo + PSB + KSB resulted in the lowest leaf yield of fenugreek. The sole application of biofertilizer with no additional organic and inorganic nutrient sources, resulted in lower crop yield due to mining of nutrients from soil and thus depletion of soil fertility gradually.

Significantly highest BCEY of the winter season was noted with fenugreek intercropped cropping systems, viz. RbC-WBc + VFg-SCp and RbC-WBc + VFg-SSc compared with RbC + WBc + SBc cropping system where only baby corn was grown. Compared to first season, ~4.4% higher BCEY was observed during the second season (Table 2). The higher BCEY (~20–24%) of fenugreek intercropped cropping system could be attributed to the additional economic return provided by fenugreek than that of sole baby corn cropping system. Among the nutrient managements, the 25% substitution of RDN through FYM, VC and LC ensued significantly ( $P=0.05$ ) higher BCEY (~5–16%) than that of 100% RDN-F during both the seasons. Under R/Azo + PSB + KSB, almost ~50% lower yield was obtained compared to 100% RDN-F (Table 2).

*Summer season (baby corn, cowpea and sweet corn);* Among the nutrient-management levels, the highest baby corn (1.59 and 1.66 Mg/ha), and green fodder yield (21.79 and 23.05 Mg/ha), over the years, were recorded with 75% RDN-F + 25% RDN-FYM, followed by 75% RDN-F + 25% RDN-VC. All the treatments with 25% RDN substituted by organic sources performed better than

Table 2. Effect of cropping systems and nutrient-management levels on baby corn-equivalent yield and net returns during various season

Treatment	BCEY (Mg/ha)						Net returns ( $\times 10^3$ ₹/ha)					
	Rainy season		Winter		Summer		Rainy season		Winter		Summer	
	2016	2017	2016-17	2017-18	2017	2018	2016	2017	2016-17	2017-18	2017	2018
<b>Cropping systems</b>												
RBc-WBc-SBc	1.99	2.08	1.76	1.84	1.76	1.81	115.2	120.3	95.4	98.5	82.1	84.3
RBc-WBc + VFg-SCp	1.97	2.18	2.40	2.52	1.28	1.51	114.1	127.0	136.0	141.9	77.1	90.3
RBc-WBc + VFg-SSc	1.99	2.07	2.33	2.40	3.03	3.07	115.1	118.0	130.5	132.6	185.5	186.6
SEM $\pm$	0.02	0.05	0.09	0.04	0.05	0.01	1.7	3.6	7.5	3.4	3.9	0.5
CD (P=0.05)	NS	NS	0.41	0.17	0.17	0.10	NS	NS	29.6	13.2	15.4	2.0
<b>Nutrient-management levels</b>												
100% RDN-F	2.03	2.10	2.12	2.23	2.00	2.16	122.4	124.9	121.0	126.2	115.8	125.6
75% RDN-F + 25% RDN-FYM	2.16	2.41	2.52	2.65	2.27	2.45	126.2	142.7	146.5	153.3	132.7	143.6
75% RDN-F + 25% RDN-VC	2.20	2.35	2.42	2.58	2.20	2.35	126.1	133.8	134.8	143.6	124.6	133.8
75% RDN-F + 25% RDN-LC	2.09	2.32	2.22	2.48	2.11	2.27	117.9	132.9	120.5	137.2	118.6	128.3
AZ/R + PSB + KSB	1.43	1.35	1.52	1.32	1.52	1.43	81.5	74.6	80.3	61.3	82.7	70.7
SEM $\pm$	0.03	0.03	0.04	0.05	0.04	0.04	2.3	2.0	3.4	3.9	3.3	2.8
CD (P=0.05)	0.08	0.08	0.12	0.14	0.12	0.10	5.2	5.9	9.9	11.4	9.6	8.2

BCEY, Baby corn equivalent yield; RBc, rainy season baby corn; WBc, winter season baby corn; SBc, summer season baby corn; VFg, vegetable fenugreek; SCp, summer season vegetable cowpea; SSc, summer season sweet corn; RDN-F, recommended dose of nitrogen through fertilizer (urea); FYM, farmyard manure; VC, vermicompost; LC, leaf compost; AZ/R + PSB + KSB, *Azotobacter/Rhizobium* + phosphorus-solubilizing bacteria + potassium-solubilizing bacteria

100% RDN-F. It might be owing to slow and steady mineralization of nitrogen resulted lower N losses and higher nitrogen-use efficiency. Similarly, highest cowpea green pod (3.65 and 4.29 Mg/ha), cowpea green stover (6.73 and 7.17 Mg/ha), sweet corn green cob (8.00 and 8.33 Mg/ha) and sweet corn green stover yield (20.61 and 21.74 Mg/ha), over the years, also recorded with 75% RDN – F + 25% RDN-FYM. However, treatments with 25% RDN substituted by VC and LC also performed better than 100% RDN – F during both the years (Table 1). Chhetri and Sinha (2020) also reported that, substitution of RDF with organic manures recorded higher maize and cowpea yields than 100% RDF through fertilizers.

The BCEY of summer baby corn, cowpea and sweet corn in respective systems were significantly differed. Significantly highest BCEY (3.03 and 3.07 Mg/ha), during both the seasons, were recorded under RBc-WBc + VFg-SSc cropping system compared with the others. The inclusion of summer sweet corn in baby corn-based cropping system increased the BCEY of summer season by 40.8–41.9% and 50.6–57.8% as compared to the inclusion of baby corn and vegetable cowpea, respectively, over the seasons (Table 2).

Among the nutrient managements, the 25% substitution of RDN through FYM, and VC gave significantly ( $P=0.05$ ) higher BCEY than that of 100% RDN-F during both the seasons. The increases in BCEY owing to the 75% RDN-F + 25% RDN-FYM and 75% RDN-F + 25% RDN-VC were ~11.5 and ~8.3%, respectively higher than 100% RDN-F. The 25% substitution of RDN through leaf compost was found at par with 100% RDN-F during the first season and significantly higher during the second. Significantly lowest BCEY was recorded with R/Azo + PSB + KSB, which were ~31 and ~51%, respectively, lower than 100% RDN-F during both the seasons (Table 2).

### Net returns

**Rainy season (baby corn):** During the rainy season, sole baby corn was grown in all the cropping systems, resulted, the net returns of all cropping systems were remained statistically at par. Compared to the first season, the highest increment in net returns (~10%) was observed with RBc-WBc-SCp cropping system during the second season. Higher net returns were attributed to yield benefits in succeeding crop owing to inclusion of legumes, viz. fenugreek and cowpea, in cropping system. Similar results were also been reported by Babu *et al.*, (2020). Among the nutrient-

management levels, the highest net returns were recorded with 75% RDN-F + 25% RDN-FYM and 75% RDN-F + 25% RDN-VC; however, it was found at par during the first season and significantly higher during the second season compared to 100% RDN-F. Due to lower economic output treatment of microbial consortium (R/Azo + PSB + KSB) recorded the lowest net returns, despite negligible treatment cost (Table 2).

*Winter season (baby corn, vegetable fenugreek):* Among the cropping systems, significantly highest net returns were recorded with RBc-WBc + VFg-SSc and RBc- WBc-SCp cropping systems, being ~25% and ~21%, respectively, higher than RBc- WBc-SBc. The higher net returns (~21–26%) of fenugreek intercropped cropping system could be attributed to the additional economic returns provided by fenugreek than that of sole baby corn cropping system. Among the nutrient-management levels, significantly highest net returns were recorded with 75% RDN-F + 25% RDN-FYM and 75% RDN-F + 25% RDN-VC compared to 100% RDN-F during both the seasons. Due to lower output, treatment of microbial consortium (R/Azo + PSB + KSB) recorded the lowest net returns, despite negligible treatment cost. The 25% substitution of RDN through leaf compost was found comparable during the first season and significantly higher in the second season than 100% RDN-F (Table 2).

*Summer season (baby corn, cowpea and sweet corn):* Net returns of various cropping system with summer baby corn, cowpea and sweet corn were differed significantly. Significantly highest net returns ( $185.5$  and  $186.6 \times 10^3$  ₹/ha), during both the seasons, were recorded with RBc-WBc + VFg-SSc cropping system. The inclusion of summer sweet corn in baby corn based-cropping system increased the net returns of summer season by 51–58% in comparison to the inclusion of baby corn (RBc-WBc-SBc) and vegetable cowpea (RBc-WBc-SCp) (Table 2). Among the nutrient management options, the 25% substitution of RDN through FYM, and VC provided significantly ( $P=0.05$ ) higher net returns than that of 100% RDN-F during both the seasons. The 25% substitution of RDN with leaf compost also revealed higher net returns than 100% RDN-F but remains at par during both the seasons. Significantly lowest net returns were recorded with R/Azo + PSB

+ KSB compared to all the remaining treatments.

Based on 2 years of investigation it can be concluded that, application of 25% RDN through urea and 75% RDN through FYM was found promising for achieving higher crop yield and net returns in baby corn-baby corn + fenugreek–sweet corn cropping system.

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