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Influence of conservation agriculture and organic nutrient management on growth and yield of soybean: French bean cropping system

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Abstract

A field experiment on “Influence of conservation agriculture and organic nutrient management on soil health and productivity of soybean – French bean cropping system” was conducted at the All India Coordinated Research Project on Integrated Farming Research System, Mahatma Phule Krishi Vidyapeeth, Rahuri (M.S.) during two consecutive years 2018-19 and 2019-20. The experiment was laid out in split plot design during *khariif* season and split-split plot design during *rabi* season with three replications. Among the tillage practices with crop residue management treatments, plant height (cm), no. of branches, leaf area plant⁻¹ (dm²), no. of root nodules plant⁻¹, dry matter production (g plant⁻¹) no. of pods plant⁻¹, no. of seeds pod⁻¹, pod weight plant⁻¹ (g), seed weight plant⁻¹ (g), 100 seed weight (g) seed yield (q ha⁻¹) and straw yield (q ha⁻¹) of soybean and plant height (cm), no. of branches, leaf area plant⁻¹ (dm²), dry matter (g plant⁻¹) no. of green pods plant⁻¹, green pod yield plant⁻¹(g), yield of green pod (q ha⁻¹) and straw yield (q ha⁻¹) of French bean was observed higher in (T₁) conventional tillage with crop residue management. In organic nutrient management, plant height (cm), no. of branches, leaf area plant⁻¹ (dm²), no. of root nodules plant⁻¹, dry matter production (g plant⁻¹) no. of pods plant⁻¹, no. of seeds pod⁻¹, pod weight plant⁻¹ (g), seed weight plant⁻¹ (g), 100 seed weight (g) seed yield (q ha⁻¹) and straw yield (q ha⁻¹) of soybean and plant height (cm), no. of branches, leaf area plant⁻¹ (dm²), dry matter (g plant⁻¹) no. of green pods plant⁻¹, green pod yield plant⁻¹(g), yield of green pod (q ha⁻¹) and straw yield (q ha⁻¹) of French bean was observed significantly higher in (F₃ and S₃) application of FYM @ 7.5 t ha⁻¹.

Keywords: Soybean-French bean, cropping system, tillage practice etc.

Introduction

Conservation Agriculture is a resource-saving agricultural production system that aims to achieve production intensification and high yields while enhancing the natural resource base through compliance with three interrelated principles i.e. minimum soil disturbance with organic soil cover and diversified crop rotation along with other good production practices of plant nutrition and pest management (Abrol and Sangar, 2006) ^[1].

In crop residue management, leaving last year's crop residue on the soil surface by limiting tillage. In this management, crop residue on the surface before and during planting operations provides cover for the soil at a critical time of the year. The residue is left on the surface by reducing tillage operations and turning the soil less. Pieces of crop residue shield soil particles from rain and wind until plants can produce a protective canopy. Incorporation of crop residues into soil or retention on the surface has several positive influences on physical, chemical and biological properties of soil (Bhale and Wanjari, 2009) ^[2].

Soybean (*Glycine max* L. Merrill) being a potentially high yielding crop. This plant is classified as oilseed rather than pulse crop as approximately 85% of the world's soybean crop is processed into soybean meal and vegetable oil.

French bean (*Phaseolus vulgaris* L.) is one of the important leguminous crops which achieve its foremost importance in cultivation in the agricultural field due to its higher nutritional index of protein in fresh pods (1.7%) as well as in dried seeds (21.1%) that serve as a cheap source of higher protein.

Materials and Methods

A field experiment on “Influence of conservation agriculture and organic nutrient management on soil health and productivity of soybean – French bean cropping system” was conducted at the All India Coordinated Research Project on Integrated Farming Research System, Mahatma Phule Krishi Vidyapeeth, Rahuri (M.S.) during two consecutive years 2018-19 and 2019-20. The experiment was laid out in split plot design during *kharif* season and split-split plot design during *rabi* season with three replications. The treatment consists of four main plot treatments of tillage practices with crop residue management *viz.*, T₁ – Conventional tillage with crop residue, T₂ – Conventional tillage without crop residue, T₃ – Minimum tillage with crop residue, T₄ – Minimum tillage without crop residue and two sub plot treatments of organic nutrient management *viz.*, F₁ – O (Control), F₂ – FYM 5 t ha⁻¹, F₃ – FYM 7.5 t ha⁻¹ for *kharif* soybean. During *rabi* season the main and sub plot treatments remains same but the sub plot treatments were divided into three sub plot treatment of organic nutrient management *viz.*, S₁ – O (Control), S₂ – FYM 5 t ha⁻¹, S₃ – FYM 7.5 t ha⁻¹ to french bean crop as a sub-sub plot treatment. Observation was recorded plant height, no. of branches and dry matter, yield and yield contributing characters. The data was analyzed using ANOVA (Analysis of variance) table.

Result and Discussion

Soybean

Effect of tillage practices with crop residue management on growth characters: The plant height (cm), no. of branches, leaf area plant⁻¹ (dm²), no. of root nodules plant⁻¹ and dry matter production (g plant⁻¹) of soybean was observed higher in (T₁) conventional tillage with crop residue management and non-

significantly influenced by different tillage practices with crop residue management during both the year of experiment.

Effect organic nutrient management on growth characters

The plant height (cm), no. of branches, and dry matter production (g plant⁻¹) of soybean was observed significantly higher in (F₃) application of FYM @7.5 t ha⁻¹ other treatments of organic nutrient management during both the year of experiment. The leaf area plant⁻¹ (dm²) and no. of root nodules plant⁻¹ of soybean was found non-significant during both the year of experiment. These results are in accordance with the findings of Koushal and Singh (2011) [6].

Effect of tillage practices with crop residue management on yield and yield contributing characters

The no. of pods plant⁻¹, no. of seeds pod⁻¹, pod weight plant⁻¹ (g), seed weight plant⁻¹ (g), 100 seed weight (g) seed yield (q ha⁻¹) and straw yield (q ha⁻¹) of soybean was observed higher in (T₁) conventional tillage with crop residue management and non-significantly influenced by different tillage practices with crop residue management during both the year of experiment.

Effect organic nutrient management on yield and yield contributing characters

The no. of pods plant⁻¹, pod weight plant⁻¹ (g), seed weight plant⁻¹ (g), 100 seed weight (g) seed yield (q ha⁻¹) and straw yield (q ha⁻¹) of soybean was observed significantly higher in (F₃) application of FYM @7.5 t ha⁻¹ other treatments of organic nutrient management during both the year of experiment. The no. of seeds pod⁻¹ of soybean was found non-significant during both the year of experiment. These results are in accordance with the findings of Bonde and Gawande (2017) [3].

Table 1: Effect of tillage practices with crop residue management and organic nutrient management on plant height (cm), No. of branches, Leaf area plant⁻¹ (dm²), No. of root nodules plant⁻¹ and Dry matter (g plant⁻¹) of soybean during 2018-19

Treatment	Plant height (cm)		No. of branches		Leaf area plant ⁻¹ (dm ²)		No. of root nodules plant ⁻¹		Dry matter (g plant ⁻¹)	
	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019
Main plot: Tillage practices with crop residue management (T)										
T ₁ – Conventional tillage with crop residue	57.02	58.71	6.50	6.89	3.78	3.86	32.57	33.55	34.12	35.14
T ₂ – Conventional tillage without crop residue	53.54	54.75	5.79	6.21	3.40	3.40	29.76	30.36	32.17	32.86
T ₃ – Minimum tillage with crop residue	55.37	56.73	6.03	6.49	3.57	3.69	31.57	32.07	33.42	34.26
T ₄ – Minimum tillage without crop residue	51.68	52.76	5.67	6.53	3.24	3.32	28.34	29.06	30.47	31.24
SE (m) ±	1.31	1.67	0.27	0.90	0.49	0.44	1.28	1.30	1.05	0.78
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Sub plot: Organic nutrient management (F)										
F ₁ – 0 (control)	49.78	49.88	5.40	5.87	3.13	3.18	28.49	29.41	28.85	29.78
F ₂ – FYM 5.0 t ha ⁻¹	54.83	55.74	5.85	6.32	3.48	3.57	30.83	31.28	32.54	32.96
F ₃ – FYM 7.5 t ha ⁻¹	58.60	61.59	6.75	7.41	3.88	3.96	32.35	33.09	36.24	37.39
S.E. (m) ±	1.03	1.95	0.26	0.29	0.26	0.34	1.38	1.19	1.19	1.36
C.D. at 5%	3.09	5.84	0.79	0.87	NS	NS	NS	NS	3.56	4.08
Interactions (T x F)										
Between two sub plots means at same level of main plot means										
SE (m) ±	2.06	3.90	0.53	0.58	0.53	0.69	2.76	2.37	2.38	2.72
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Between two main plots means at same level of sub plot means										
SE (m) ±	2.14	3.59	0.51	1.02	0.65	0.71	2.59	2.34	2.21	2.36
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
General mean	54.40	55.74	6.00	6.53	3.50	3.57	30.56	31.26	32.54	33.38

Table 2: Effect of tillage practices with crop residue management and organic nutrient management on no. of pods plant⁻¹, no. of seeds pod⁻¹, pod weight plant⁻¹ (g), seed weight plant⁻¹ (g), 100 seed weight (g) seed yield (q ha⁻¹) and straw yield (q ha⁻¹) of soybean during 2018, 2019 and pooled

Treatment	Number of pods plant ⁻¹			Number of seeds pod ⁻¹			Seed weight plant ⁻¹ (g)			100 seed weight (g)			Seed yield (q ha ⁻¹)			Straw yield (q ha ⁻¹)		
	2018	2019	pooled	2018	2019	pooled	2018	2019	pooled	2018	2019	Pooled	2018	2019	pooled	2018	2019	pooled
Main plot: Tillage practices with crop residue management (T)																		
T1 – Conventional tillage with crop residue	69.24	70.79	70.02	2.14	2.20	2.17	26.59	27.39	26.99	10.50	10.90	10.70	24.13	26.23	25.18	30.40	31.76	31.08
T2 – Conventional tillage without crop residue	63.88	65.99	64.94	1.93	1.96	1.95	25.74	26.53	26.13	9.35	9.79	9.57	19.14	21.52	20.33	28.46	28.65	28.56
T3 – Minimum tillage with crop residue	66.57	65.36	65.96	2.07	2.12	2.09	26.24	26.84	26.54	9.97	10.44	10.21	21.93	24.05	22.99	28.93	30.35	29.64
T4 – Minimum tillage without crop residue	62.06	64.24	63.15	1.79	1.86	1.82	24.43	25.01	24.72	9.02	9.24	9.13	17.68	18.08	17.88	24.75	28.61	26.68
SE (m) ±	1.74	2.93	1.70	0.14	0.47	0.25	2.08	0.87	1.13	0.39	0.42	0.29	1.55	2.09	1.30	1.88	0.88	1.04
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	4.01	NS	NS	NS
Sub plot: Organic nutrient management (F)																		
F1 – 0 (control)	59.11	60.84	59.98	1.65	1.70	1.67	23.09	23.44	23.27	8.04	8.59	8.32	16.55	17.81	17.18	22.57	24.12	23.34
F2 – FYM 5.0 t ha ⁻¹	64.90	65.80	65.35	1.98	2.03	2.01	25.37	26.28	25.83	9.70	9.99	9.85	21.45	22.70	22.07	29.34	30.91	30.13
F3 – FYM 7.5 t ha ⁻¹	72.30	73.15	72.73	2.32	2.38	2.35	28.78	29.60	29.19	11.39	11.70	11.54	24.16	26.90	25.53	32.50	34.50	33.50
S.E. (m) ±	2.37	2.41	1.69	0.19	0.25	0.16	1.03	0.97	0.71	0.55	0.51	0.38	0.95	1.19	0.76	0.85	1.07	0.68
C.D. at 5%	7.10	7.24	4.87	NS	NS	0.45	3.10	2.92	2.04	1.66	1.53	1.08	2.86	3.57	2.20	2.56	3.20	1.97
Interactions (T x F)																		
Between two sub plots means at same level of main plot means																		
SE (m) ±	4.74	4.83	3.38	0.37	0.50	0.31	2.06	1.95	1.42	1.11	1.02	0.75	1.91	2.38	1.53	1.71	2.14	1.37
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Between two main plots means at same level of sub plot means																		
SE (m) ±	4.24	4.91	3.25	0.33	0.63	0.35	2.68	1.81	1.62	0.99	0.93	0.68	2.19	2.86	1.80	2.34	1.96	1.52
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
General mean	65.44	66.60	66.02	1.98	2.04	2.01	25.75	26.44	26.10	9.71	10.09	9.90	20.72	22.47	21.59	28.14	29.84	28.99

French bean

Effect of tillage practices with crop residue management on growth characters: The plant height (cm), no. of branches, leaf area plant⁻¹ (dm²) and dry matter (g plant⁻¹) of French bean was observed higher in (T1) conventional tillage with crop residue management and non-significantly influenced by different tillage practices with crop residue management during both the year of experiment.

Effect organic nutrient management on growth characters

The plant height (cm), no. of branches, leaf area plant⁻¹ (dm²) and dry matter (g plant⁻¹) of French bean was observed significantly higher in (F3) application of FYM @7.5 t ha⁻¹ other treatments of organic nutrient management during both the year of experiment. This result was found similarly to the Shah *et al.* (2015).

Effect organic nutrient management (Rabi French bean) on growth characters:

The plant height (cm), no. of branches, leaf area plant⁻¹ (dm²) and dry matter (g plant⁻¹) of French bean was observed significantly higher in (F3) application of FYM @7.5 t ha⁻¹ other treatments of organic nutrient management during both the year of experiment. Similar findings were observed by Jamliya *et al.* (2018) [5].

Effect of tillage practices with crop residue management on yield and yield contributing characters:

The no. of green pods

plant⁻¹, green pod yield plant⁻¹(g), yield of green pod (q ha⁻¹) and straw yield (q ha⁻¹) of French bean was observed higher in (T1) conventional tillage with crop residue management and non-significantly influenced by different tillage practices with crop residue management during both the year of experiment.

Effect organic nutrient management on yield and yield contributing characters

The no. of green pods plant⁻¹, green pod yield plant⁻¹(g), yield of green pod (q ha⁻¹) and straw yield (q ha⁻¹) of French bean was observed significantly higher in (F3) application of FYM @7.5 t ha⁻¹ other treatments of organic nutrient management during both the year of experiment. The no. of seeds pod⁻¹ was found non-significant during both the year of experiment. Similar findings were observed by Ghodke *et al.* (2018) [4].

Effect organic nutrient management (Rabi French bean) on yield and yield contributing characters

The no. of green pods plant⁻¹, green pod yield plant⁻¹ (g), yield of green pod (q ha⁻¹) and straw yield (q ha⁻¹) of French bean was observed significantly higher in (F3) application of FYM @7.5 t ha⁻¹ other treatments of organic nutrient management during both the year of experiment. The no. of seeds pod⁻¹ was found non-significant during both the year of experiment. These results are in close proximity to those reported by Lohar and Hase *et al.* (2022) [7].

Table 3: Effect of tillage practices with crop residue management and organic nutrient management on plant height (cm), No. of branches, Leaf area plant⁻¹ (dm²) and Dry matter (g plant⁻¹) of French bean during 2018-19

Treatment	Plant height (cm)		No. of branches plant ⁻¹		Leaf area plant ⁻¹ (dm ²)		Dry matter (g plant ⁻¹)	
	2018	2019	2018	2019	2018	2019	2018	2019
Main plot: Tillage practices with crop residue management (T)								
T1 – Conventional tillage with crop residue	63.19	65.26	14.19	14.68	23.33	24.10	35.97	37.22
T2 – Conventional tillage without crop residue	61.22	63.16	13.72	14.18	22.61	23.32	34.77	35.95
T3 – Minimum tillage with crop residue	62.08	64.42	13.93	14.48	22.92	23.79	35.30	36.71
T4 – Minimum tillage without crop residue	59.81	61.80	13.39	13.86	22.09	22.82	33.92	35.13
SE (m) ±	0.732	1.161	0.17	0.27	0.27	0.43	0.44	0.70
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS
Sub plot: Organic nutrient management (F)								
F1 – 0 (control)	58.38	60.63	13.05	13.58	21.56	22.39	33.06	34.42
F2 – FYM 5.0 t ha ⁻¹	60.78	63.02	13.62	14.15	22.44	23.27	34.51	35.86
F3 – FYM 7.5 t ha ⁻¹	65.56	67.33	14.75	15.17	24.21	24.86	37.40	38.47
S.E. (m) ±	0.84	1.01	0.20	0.24	0.31	0.37	0.51	0.61
C.D. at 5%	2.51	3.02	0.59	0.71	0.93	1.12	1.52	1.83
Sub-sub plot treatment: Organic nutrient management- For rabi French bean (S)								
S1 – 0 (control)	57.06	60.68	12.74	13.59	21.07	22.41	32.26	34.45
S2 – FYM 5.0 t ha ⁻¹	62.16	63.07	13.94	14.16	22.95	23.29	35.35	35.90
S3 – FYM 7.5 t ha ⁻¹	65.50	67.23	14.73	15.14	24.19	24.83	37.37	38.41
S.E. (m) ±	0.87	1.29	0.21	0.30	0.32	0.48	0.53	0.78
C.D. at 5%	2.48	3.66	0.59	0.86	0.92	1.35	1.50	2.21
Interactions								
T x F								
SE (m) ±	1.67	2.02	0.40	0.48	0.62	0.74	1.01	1.22
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS
T x S								
SE (m) ±	1.74	2.57	0.41	0.61	0.64	0.95	1.05	1.56
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS
F x S								
SE (m) ±	1.51	2.23	0.36	0.53	0.56	0.82	0.91	1.35
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS
T x F x S								
SE (m) ±	3.02	4.46	0.71	1.05	1.11	1.65	1.83	2.70
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS
General mean	61.57	63.66	13.81	14.30	22.74	23.51	34.99	36.25

Table 4: Effect of tillage practices with crop residue management and organic nutrient management on no. of green pods plant⁻¹, green pod yield plant⁻¹ (g), yield of green pod (q ha⁻¹) and straw yield (q ha⁻¹) of French bean during 2018, 2019 and pooled

Treatment	Number of green pods plant ⁻¹			Green pod yield plant ⁻¹ (g)			Yield of green pod (q ha ⁻¹)			Straw yield		
	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Pooled
Main plot: Tillage practices with crop residue management (T)												
T1 – Conventional tillage with crop residue	37.69	38.88	38.28	201.55	208.87	205.21	65.56	66.60	66.08	74.04	76.49	75.26
T2 – Conventional tillage without crop residue	36.57	37.68	37.12	194.61	201.47	198.04	62.10	64.17	63.13	71.72	74.01	72.86
T3 – Minimum tillage with crop residue	37.06	38.40	37.73	197.66	205.90	201.78	63.06	66.34	64.70	72.74	75.49	74.11
T4 – Minimum tillage without crop residue	35.76	36.90	36.33	189.65	196.65	193.15	58.48	60.56	59.52	70.06	72.40	71.23
SE (m) ±	0.42	0.66	0.68	2.58	4.09	4.19	1.37	1.73	1.34	0.86	1.37	1.40
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Sub plot: Organic nutrient management (F)												
F1 – 0 (control)	34.95	36.23	35.59	184.62	192.56	188.59	59.38	60.73	60.06	68.38	71.03	69.71
F2 – FYM 5.0 t ha ⁻¹	36.32	37.59	36.96	193.06	200.95	197.01	61.08	63.48	62.28	71.20	73.84	72.52
F3 – FYM 7.5 t ha ⁻¹	39.05	40.06	39.55	209.92	216.16	213.04	66.43	69.06	67.74	76.84	78.92	77.88
S.E. (m) ±	0.48	0.58	0.65	2.95	3.55	4.00	1.45	1.10	1.58	0.98	1.19	1.34
C.D. at 5%	1.43	1.73	1.87	8.83	10.65	11.52	4.35	3.31	4.55	2.95	3.56	3.85
Sub-sub plot treatment: Organic nutrient management- For rabi French bean (S)												
S1 – 0 (control)	34.19	36.26	35.22	179.95	192.70	186.33	57.23	60.77	59.00	66.82	71.08	68.95
S2 – FYM 5.0 t ha ⁻¹	37.11	37.63	37.37	197.95	201.15	199.55	63.34	63.58	63.46	72.83	73.91	73.37
S3 – FYM 7.5 t ha ⁻¹	39.01	40.00	39.51	209.71	215.81	212.76	66.34	68.91	67.62	76.77	78.80	77.78
S.E. (m) ±	0.50	0.74	0.77	3.07	4.53	4.74	0.98	1.44	1.51	1.03	1.52	1.59
C.D. at 5%	1.42	2.09	2.16	8.73	12.89	13.31	2.79	4.10	4.24	2.92	4.31	4.45
Interactions												
T x F												
SE (m) ±	0.96	1.15	1.30	5.89	7.11	8.00	2.90	2.21	3.16	1.97	2.38	2.67
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
T x S												
SE (m) ±	1.00	1.47	1.54	6.14	9.07	9.48	1.96	2.88	3.02	2.05	3.03	3.17
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
F x S												
SE (m) ±	0.86	1.27	1.33	5.32	7.85	8.21	1.70	2.50	2.62	1.78	2.62	2.75

C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
T x F x S												
SE (m) ±	1.72	2.55	2.66	10.64	15.70	16.43	3.40	4.99	5.23	3.56	5.25	5.49
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
General mean	36.77	37.96	37.37	195.87	203.22	199.54	62.30	64.42	63.36	72.14	74.60	73.37

Conclusion

Among the different treatments of tillage practices with crop residue management and organic nutrient management, conventional tillage with crop residue and application of FYM @7.5 t ha⁻¹ was found superior for Soybean-French bean cropping system during both the year of experiment (2018-19).

References

1. Abrol IP, Sangar S. Sustaining Indian agriculture-conservation agriculture the way forward. *Curr. Sci.* 2006;91(8):1020-1025.
2. Bhale VM, Wanjari SS. Conservation agriculture: A new paradigm to increase resource use efficiency. *Indian J Agron.* 2009;54(2):167-177.
3. Bonde AS, Gawande SN. Effect of integrated nutrient management on soil properties and yield of soybean (*Glycine max*). *Ann Plant Soil Res.* 2017;19(2):205-209.
4. Ghodke PD, Takankhar VG, Madane AJ. Influence of INM on nutrient uptake and quality of soybean in black cotton soil of Maharashtra. *Int J Chem Stud.* 2018;6(4):267-271.
5. Jamliya GS, Vyas MD, Jaga PK. Effect of fertilizer with and without FYM on yield, nutrient uptake, and balance in soybean (*Glycine max* (L.) Merrill) in Vindhyan Plateau of Madhya Pradesh. *Ann Plant Soil Res.* 2018;20(1):81-85.
6. Koushal S, Singh P. Effect of integrated use of fertilizer, FYM, and biofertilizer on growth and yield performance of soybean (*Glycine max* (L.) Merrill). *Res J Agric. Sci.*, 2011, 43(3).
7. Lohar RR, Hase CP. Sustainable production of soybean (*Glycine max* L.) crop through chemical fertilizers and organic manures along with the improvement in soil health. *Nat Environ Pollut. Technol.* 2022;21(4):1721-1728.