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Effect of Integrated Nutrient Management on Nodulation, Yield, Quality, Energetics and Economics of Soybean [*Glycine max* (L.) Merrill.] Varieties in Eastern India

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ABSTRACT

Background: The oilseed crop soybean has the potential to bridge the demand-supply gap of edible oil. Varietal adaptation to environment and agronomic interventions like integrated nutrient management (INM) are hypothesized to elevate the yield, quality and save energy in soybean, assuring environmental safety.

Methods: The experiment was conducted in three times replicated factorial randomized block design (RBD) with 3 varieties and 5 INM options at Instructional Farm, Bidhan Chandra Krishi Viswavidyalaya, West Bengal during *kharif* season of 2019 and 2020.

Result: Comparatively greater nodules/plant (51.21) and dry weight of nodules (0.51 g), pods/plant (34.04), 100-seeds weight (15.24 g), yield (2601 kg/ha), protein (41.42%) and economic profitability (B:C- 2.32) were observed from PS 24 grown under 75% RDF + 1.5t/ha vermicompost + 25 kg/ha $ZnSO_4$. Energy budgeting further indicated that soybean cultivation mostly consumed energy from indirect non-renewable sources and PS 24 grown under that INM option generated highest energy outcome (112679.3 MJ/ha) in Eastern Indian condition.

Key words: Economic profitability, Energy, INM, Protein, Soybean variety, Yield.

INTRODUCTION

Soybean [*Glycine max* (L.) Merrill.], being first in the world as a supplier of vegetable protein (60%) and edible oil (30%), is a great source of micronutrients and minerals for human and animal diets (Yan *et al*., 2015). India contributes only 2.75% of the global production from 10% (12 mha) of the global area (122.68 mha) due to its low productivity (0.98 t/ha) (USDA, 2020). Since history, oilseeds have played pivotal role in human life through their multiple uses. However, now, India has a huge shortfall of edible oil production and meets nearly 50% of the requirement through imports, resulting in demand-supply gap as well as high market price. The projected demand of edible oil is likely to be increased from 25.26 mt in 2020 to 35.90 mt in 2050 (FICCI, 2015). In this scenario, high attention towards soybean cultivation may play a major role to meet the edible oil deficit and it could be achieved by augmenting the present crop yield level.

Improved varieties, in any crop, are the pre-requisite for increasing productivity. The yield of soybean is due to interaction of variety's genetic potential and environment. Therefore, response to crop management and environment varies markedly with soybean varieties. However, variety specific standardization of agro-techniques across the agro-climatic zones is still lacking. In this regard, appropriate nutrient management can play a key role. Excessive, unscientific chemical fertilizer application leads to environmental foot-prints and stagnation in production through destroying soil health, while unavailability of bulky organic manures is also a constraint. So, integrated nutrient management (INM) incorporating balanced use of organic and inorganic nutrient sources can create a win-win situation for sustaining the soybean productivity by eliminating the constraints and utilizing their individual benefits (Maheshbabu *et al*., 2008). Therefore, the present experiment was conducted with the aim to uplift soybean productivity in eastern India by selecting improved variety through its response to ideal INM option.

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MATERIALS AND METHODS

The field experiment was carried out at Instructional Farm, Bidhan Chandra Krishi Viswavidyalaya, West Bengal (22° N latitude, 89°E longitude and 9.75 m above MSL) during *kharif* season of 2019 and 2020. The sandy-loam experimental soil had soil pH of 7.20, organic carbon of 0.61%, available nitrogen, phosphorus and potassium of 191.8, 27.1 and 171.5 kg/ha, respectively and zinc of 0.50 ppm. The crop received rainfalls of 1017.1 and 1077.1 mm during experimental period of 2019 and 2020, respectively. The fully rainfed experiment followed factorial RBD comprising 3 soybean varieties (V_1: PS 1225; V_2: YEZIN 15; V_3: PS 24) and 5 nutrient management options (N_1: 100% RDF *i.e.*, N: P_2O_5: K_2O-20:60:40kg/ha; N_2: 75% RDF + 3t/ha FYM; N_3: 75% RDF+ 1.5t/ha vermicompost; N_4: N_2 + 25kg/ha $ZnSO_4$; N_5: N_3 + 25kg/ha $ZnSO_4$), replicated thrice. As per the treatments, organic manures were applied during land preparation and fertilizers (urea, S.S.P. and M.O.P. and $ZnSO_4$, $7H_2O$ for N, P_2O_5, K_2O and Zn, respectively) were applied at basal. Individual plot size was 4.5 m × 3 m. Soybean seeds @75 kg/ha were sown at a spacing of 45 cm × 10 cm on 28th and 25th June in 2019 and 2020, respectively. YEZIN 15 was harvested at around 110 DAS, while rests were harvested at around 115 DAS.

Observations included nodules/plant, dry weight of nodules/plant (g), pods/plant, seeds/pod, 100-seeds weight (g), seed yield (kg/ha), oil and protein contents (%), energetics and economics of soybean cultivation. Oil and protein were estimated using Soxhlet-apparatus (Ajayi *et al*., 2004) and method suggested by Gupta *et al*. (1972) (nitrogen content × 6.25), respectively. Energetics included source wise energy sharing (direct, indirect, renewable and non-renewable sources) (Fig 1) and energy indices. Energy involved in all the inputs and outputs were computed using their energy equivalent values as shown in Table 1. Energy indices were calculated using the following formulae:

$$\text{Net energy gain (NEG)} = \text{Energy output (EO)- Energy input (EI)}$$

$$\text{Energy ratio (ER)} = \frac{\text{EO}}{\text{EI}}$$

$$\text{Specific energy (SE)} = \frac{\text{EI}}{\text{Biological yield (BY)}}$$

$$\text{Energy productivity (EP)} = \frac{\text{BY}}{\text{EI}}$$

$$\text{Energy profitability (EPt)} = \frac{\text{NEG}}{\text{EI}}$$

Economic analysis was done based on cost of cultivation, gross return, net return and benefit-cost ratio (B:C). Experimental data were statistically analysed by 'analysis of variance' method (Panse and Sukhatme, 1967). Treatment means were compared using critical difference values at 5% level of significance.

RESULTS AND DISCUSSION

Nodules count and dry weight/plant

Results (Table 1) indicated that variety V_3 registered maximum nodules count (46.55) and dry weight (0.47g) (pooled). It might be due to higher proliferation and activities of *Rhizobium* as well as adequate root growth under favourable physico-chemical soil condition. Irrespective of years and pooled analysis, V_2 produced lowest nodule numbers and dry weight/plant. Dependence of nodulation

Table 1: Equivalent energy of different inputs and outputs of soybean cultivation.

Particulars	Unit	Equivalent energy (MJ)	References
Inputs			
Adult man	Man-hour	1.96	Sadorsky (2006)
Bullock (medium size-body weight: 352-450 kg)	Pair-hour	10.10	Mittal *et al.* (1985)
Diesel	Litre	56.31	Mittal *et al.* (1985)
Electricity	KW	11.93	Mittal *et al.* (1985)
Machinery/Electric motor (tractor, power tiller, pump *etc.*)	kg	64.80	Devasenapathy *et al.* (2009)
Farm machinery (sprayer *etc.*)	kg	62.70	Mittal *et al.* (1985)
N	kg	60.60	Mittal *et al.* (1985)
P_2O_5	kg	11.10	Mittal *et al.* (1985)
K_2O	kg	6.70	Mittal *et al.* (1985)
$ZnSO_4$	kg	20.90	Devasenapathy *et al.* (2009)
FYM	kg	0.30	Devasenapathy *et al.* (2009)
Vermicompost	kg	0.30	Devasenapathy *et al.* (2009)
Chemicals (herbicides and pesticides)	kg or litre	120.00	Mittal *et al.* (1985)
Soybean seed	kg	18.14	Kitani (1999)
Outputs			
Seed	kg	18.14	Kitani (1999)
Stover	kg	12.50	Kitani (1999)

MJ: Mega joule.

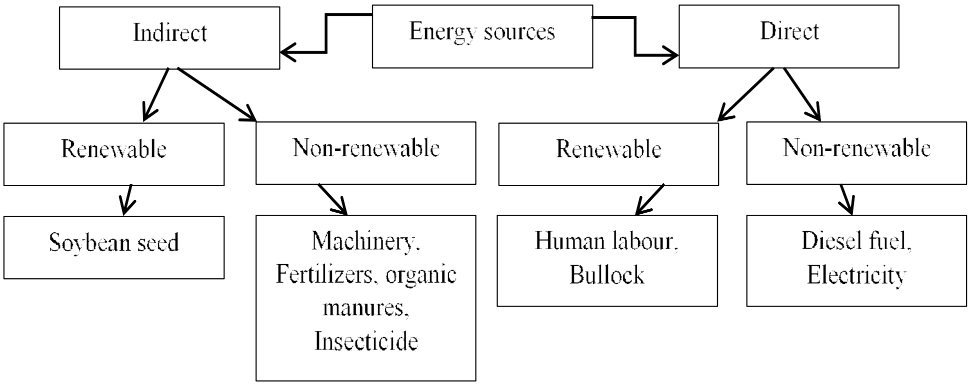

Fig 1: Different sources of energy input.

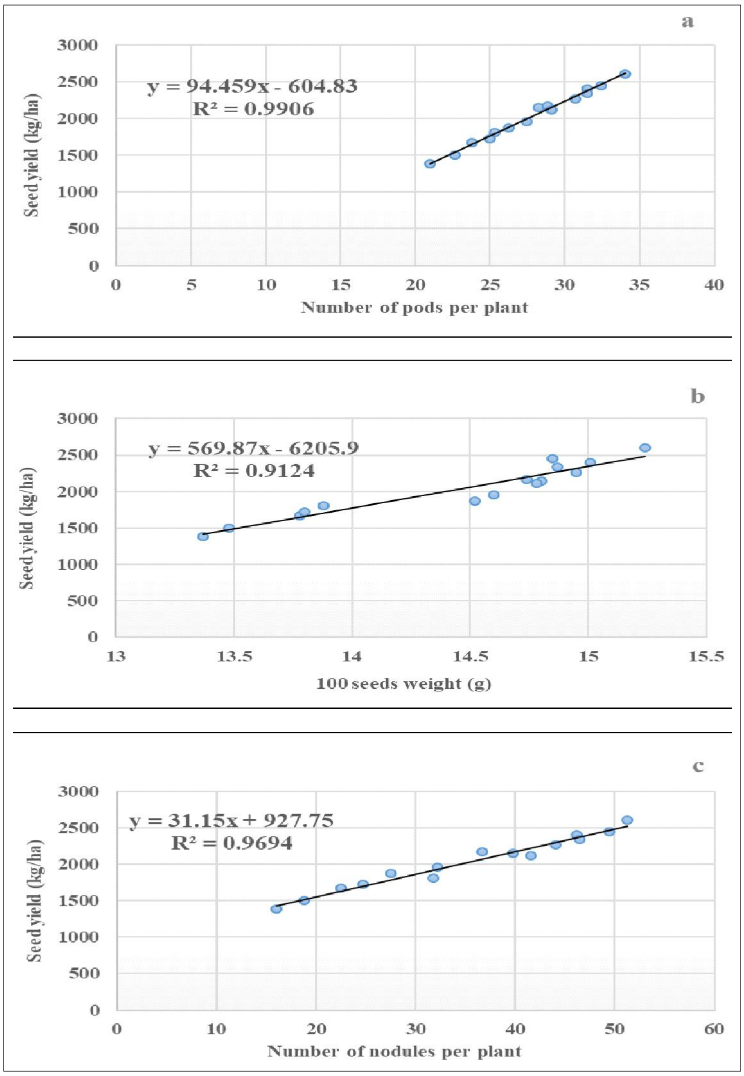

Fig 2 (a, b, c): Relationship between seed yield and (a) number of pods per plant, (b) 100 seeds weight, (c) number of nodules per plant.

Table 2: Effect of integrated nutrient management on nodulation, yield attributes and yield of soybean varieties.

Treatments	Number of nodules/plant			Dry weight of nodules/plant (g)			Number of pods/plant			Number of seeds/pod			100-seeds weight (g)			Seed yield (kg/ha)		
	2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled
Varieties (V)																		
V_1	38.14	32.59	35.36	0.44	0.37	0.40	28.53	26.54	27.54	2.38	2.45	2.41	14.59	14.29	14.44	2101	1974	2038
V_2	26.82	20.84	23.83	0.38	0.30	0.34	25.42	23.51	24.46	2.30	2.39	2.35	14.10	13.81	13.96	1734	1635	1685
V_3	48.80	44.31	46.55	0.50	0.44	0.47	32.68	30.42	31.55	2.33	2.41	2.37	15.08	14.79	14.94	2421	2287	2354
S. Em. (±)	1.27	0.90	1.08	0.01	0.007	0.008	0.42	0.38	0.40	0.03	0.03	0.03	0.05	0.04	0.04	35.28	30.34	32.97
C. D. (P=0.05)	3.72	2.63	3.17	0.03	0.02	0.02	1.22	1.13	1.17	NS	NS	NS	0.15	0.12	0.13	103.12	88.68	86.37
Nutrient management (N)																		
N_1	29.16	24.17	26.66	0.39	0.31	0.35	25.88	23.38	24.88	2.32	2.45	2.38	14.12	13.83	13.97	1780	1658	1719
N_2	34.08	29.10	31.59	0.42	0.35	0.38	27.33	25.12	26.22	2.34	2.43	2.39	14.23	13.98	14.11	1921	1795	1858
N_3	41.52	36.22	38.87	0.46	0.39	0.42	29.80	28.13	28.97	2.34	2.40	2.37	14.88	14.57	14.72	2208	2103	2156
N_4	38.52	33.35	35.93	0.45	0.38	0.41	29.40	27.48	28.44	2.36	2.42	2.39	14.61	14.33	14.47	2136	2013	2075
N_5	46.32	40.07	43.19	0.49	0.42	0.45	31.97	29.99	30.98	2.31	2.38	2.35	15.11	14.79	14.95	2380	2259	2320
S. Em. (±)	1.67	1.20	1.43	0.01	0.01	0.01	0.58	0.43	0.51	0.04	0.03	0.02	0.07	0.06	0.06	41.76	37.13	39.45
C. D. (P=0.05)	4.88	3.53	4.20	0.04	0.03	0.03	1.70	1.26	1.49	NS	NS	NS	0.20	0.18	0.19	122.06	108.53	115.31
Interaction (V×N)																		
V_1N_1	24.46	20.47	22.46	0.37	0.30	0.33	24.89	22.65	23.77	2.39	2.46	2.43	13.92	13.65	13.78	1737	1595	1666
V_1N_2	34.52	29.15	31.83	0.44	0.36	0.40	26.69	23.94	25.32	2.38	2.52	2.45	13.95	13.80	13.88	1866	1755	1811
V_1N_3	42.83	36.65	39.74	0.47	0.39	0.43	29.72	26.75	28.23	2.34	2.50	2.42	14.93	14.68	14.80	2204	2087	2145
V_1N_4	39.76	33.52	36.64	0.45	0.38	0.41	28.92	28.78	28.85	2.41	2.38	2.40	14.95	14.52	14.74	2212	2115	2164
V_1N_5	49.12	43.17	46.14	0.50	0.42	0.46	32.41	30.57	31.49	2.36	2.40	2.38	15.19	14.84	15.01	2484	2320	2402
V_2N_1	18.16	13.76	15.96	0.32	0.25	0.28	22.37	19.66	21.01	2.27	2.46	2.36	13.52	13.21	13.37	1432	1330	1381
V_2N_2	21.37	16.32	18.84	0.33	0.28	0.30	23.65	21.71	22.68	2.30	2.40	2.35	13.64	13.32	13.48	1545	1452	1498
V_2N_3	30.29	24.59	27.44	0.42	0.33	0.37	26.62	25.89	26.26	2.33	2.32	2.33	14.72	14.31	14.52	1925	1820	1873
V_2N_4	27.58	21.83	24.70	0.40	0.31	0.35	26.32	23.59	24.95	2.32	2.43	2.37	13.86	13.75	13.80	1777	1662	1720
V_2N_5	36.72	27.72	32.22	0.45	0.35	0.40	28.15	26.68	27.42	2.28	2.34	2.31	14.76	14.44	14.60	2001	1912	1957
V_3N_1	44.85	38.29	41.57	0.48	0.40	0.44	30.37	27.82	29.09	2.32	2.43	2.38	14.92	14.63	14.78	2181	2048	2114
V_3N_2	46.37	41.82	44.09	0.49	0.41	0.45	31.65	29.71	30.68	2.35	2.37	2.36	15.10	14.81	14.95	2351	2177	2264
V_3N_3	51.46	47.43	49.44	0.51	0.47	0.49	33.07	31.76	32.42	2.36	2.41	2.39	14.99	14.71	14.85	2495	2402	2449
V_3N_4	48.20	44.71	46.45	0.50	0.45	0.47	32.97	30.08	31.52	2.34	2.45	2.40	15.02	14.73	14.87	2420	2262	2341
V_3N_5	53.11	49.31	51.21	0.53	0.50	0.51	35.35	32.73	34.04	2.31	2.39	2.35	15.38	15.10	15.24	2656	2545	2601
S. Em. (±)	1.82	1.40	1.61	0.02	0.01	0.01	0.80	0.72	0.76	0.06	0.08	0.06	0.09	0.09	0.08	53.86	50.07	52.31
C. D. (P= 0.05)	5.33	4.10	4.71	0.05	0.04	0.04	2.34	2.10	2.22	NS	NS	NS	0.26	0.26	0.26	157.42	146.37	152.89

Table 3: Effect of integrated nutrient management on oil and protein contents of soybean varieties.

Treatments	Oil content (%)			Protein content (%)		
	2019	2020	Pooled	2019	2020	Pooled
Varieties (V)						
V_1	19.73	18.94	19.33	39.48	38.62	39.05
V_2	20.96	20.13	20.55	37.93	37.76	37.84
V_3	19.41	18.49	18.95	40.58	39.94	40.26
S. Em. (±)	0.40	0.38	0.39	0.17	0.15	0.16
C. D. (P=0.05)	1.17	1.12	1.15	0.50	0.45	0.48
Nutrient management (N)						
N_1	20.59	19.71	20.15	38.56	37.59	38.07
N_2	20.32	19.43	19.87	38.57	38.22	38.39
N_3	19.78	18.95	19.36	39.73	39.43	39.58
N_4	19.98	19.21	19.59	39.12	38.44	38.78
N_5	19.50	18.62	19.06	40.68	40.17	40.42
S. Em. (±)	0.47	0.45	0.46	0.29	0.27	0.28
C. D. (P=0.05)	NS	NS	NS	0.85	0.80	0.83
Interaction (V×N)						
V_1N_1	20.53	19.42	19.98	38.16	37.72	37.94
V_1N_2	20.02	19.16	19.59	38.58	37.33	37.96
V_1N_3	19.31	18.93	19.12	39.79	39.49	39.64
V_1N_4	19.57	18.81	19.19	39.32	38.16	38.74
V_1N_5	19.23	18.37	18.88	41.53	40.42	40.98
V_2N_1	21.47	20.89	21.18	37.36	36.97	37.16
V_2N_2	21.32	20.56	20.94	37.52	37.89	37.70
V_2N_3	20.62	19.73	20.18	38.13	38.17	38.15
V_2N_4	21.16	20.12	20.64	37.82	36.83	37.32
V_2N_5	20.25	19.35	19.80	38.82	38.96	38.89
V_3N_1	19.78	18.82	19.30	40.16	38.10	39.13
V_3N_2	19.62	18.57	19.09	39.61	39.46	39.54
V_3N_3	19.42	18.21	18.81	41.28	40.67	40.98
V_3N_4	19.22	18.71	18.96	40.23	40.33	40.28
V_3N_5	19.02	18.15	18.59	41.69	41.15	41.42
S. Em. (±)	0.53	0.51	0.52	0.33	0.31	0.32
C. D. (P=0.05)	1.56	1.50	1.53	0.98	0.92	0.95

Table 4: Energy indices of soybean cultivation under INM options (pooled).

Treatment combinations	EI (MJ/ha)	EO (MJ/ha)	NEG (MJ/ha)	ER	SE (MJ/kg)	EP (kg/MJ)	EPt
V_1N_1	6466.1	80196.2	73730.1	12.4	1.14	0.88	11.4
V_1N_2	6829.6	87580.0	80750.3	12.8	1.10	0.91	11.8
V_1N_3	6379.6	96513.1	90133.5	15.1	0.95	1.06	14.1
V_1N_4	7352.1	95908.4	88556.3	13.0	1.10	0.91	12.0
V_1N_5	6902.1	104059.8	97157.7	15.1	0.95	1.05	14.1
V_2N_1	6466.1	68470.1	62004.0	10.6	1.34	0.75	9.6
V_2N_2	6829.6	73601.5	66771.9	10.8	1.31	0.76	9.8
V_2N_3	6379.6	85104.7	78725.0	13.3	1.07	0.93	12.3
V_2N_4	7352.1	80948.0	73595.9	11.0	1.29	0.78	10.0
V_2N_5	6902.1	88359.7	81457.5	12.8	1.12	0.90	11.8
V_3N_1	6466.1	97288.3	90822.2	15.0	0.95	1.06	14.0
V_3N_2	6829.6	101487.7	94658.1	14.9	0.96	1.04	13.9
V_3N_3	6379.6	107628.3	101248.7	16.9	0.85	1.18	15.9
V_3N_4	7352.1	104484.5	97132.4	14.2	1.01	0.99	13.2
V_3N_5	6902.1	112679.3	105777.2	16.3	0.88	1.14	15.3

on soybean variety was earlier confirmed by Vyas and Kushwah (2015). These parameters also varied significantly under INM options. Greater nodulation was observed in INM options over N_1. Application of N_5 ensured maximum nodules count (43.19) and dry weight (0.45 g) (pooled). Specifically, V_3N_5 exhibited maximum nodule numbers and dry weight/ plant, followed by V_3N_3. Application of vermicompost as well as zinc might play positive role in root growth and biological activities of soil and thereby, influenced nodulation of legume plant. Solanki *et al*. (2018) also stated that nodule number and dry weight were enhanced by INM options over N_1.

Yield attributes and seed yield

Regarding yield attributes and yield of soybean (Table 2), varieties showed significant differences among themselves except seeds/pod. Variety V_3 expressed the highest number of pods/plant (31.55), seeds/pod (2.41) and 100 seeds weight (14.94 g) (pooled), followed by V_1. Similarly, in seed yield, V_3 outperformed others (2354 kg/ha) (pooled). Greater variations in yield were probably due to variable genetic makeup among varieties. PS 24 due to greater adaptation potential, better utilized the resources; exhibited higher photosynthetic efficiency and translocation of photo-assimilates to reproductive organs over others. Meena *et al*. (2016) also confirmed strong influence of genetic factors on soybean yield.

Application of N_5 ensured the highest number of pods/ plant (30.98), 100 seeds weight (14.95 g) and yield (2320kg/ ha) (pooled), followed by application of N_3 possibly due to positive influence of vermicompost on soil physical, chemical

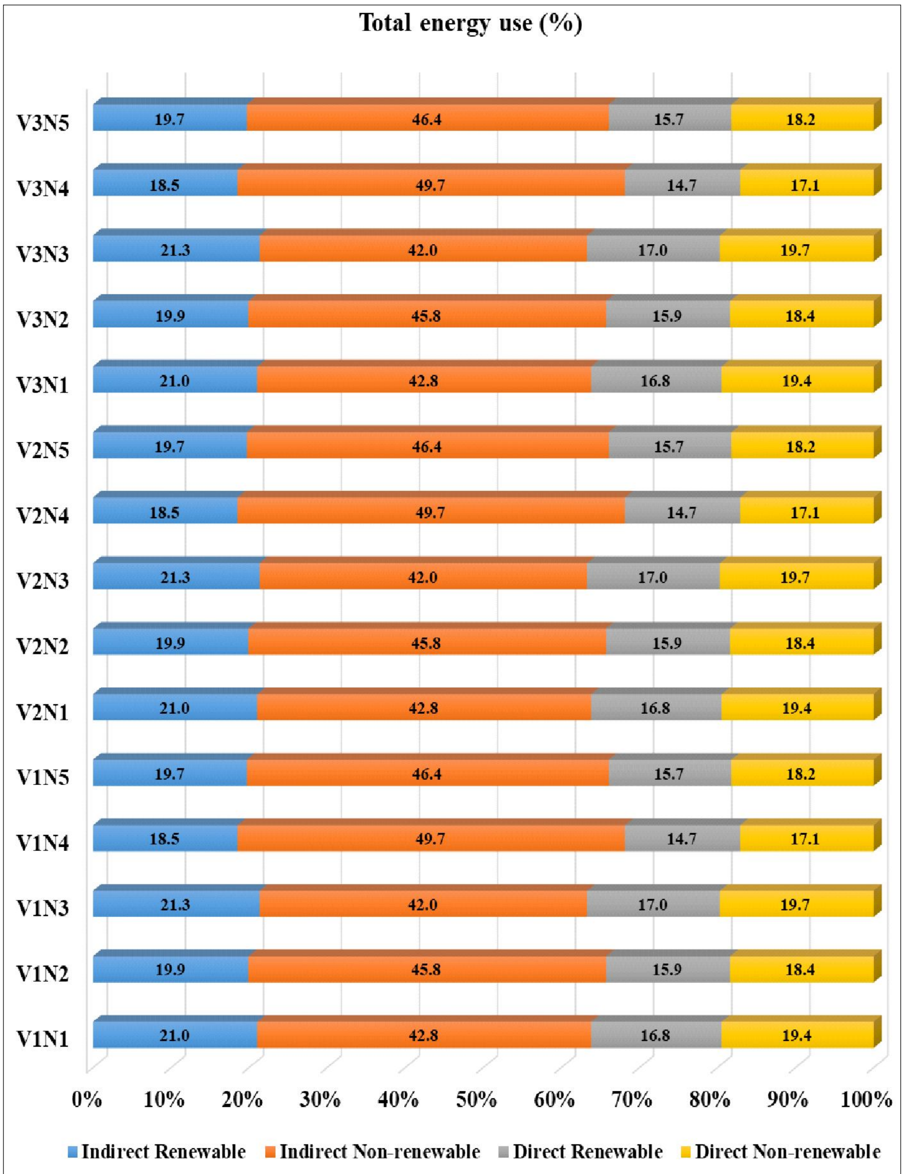

Fig 3: Source wise partitioning of total energy use (%).

and biological health, greater availability, uptakes of nutrients, supply of various growth promoting substances. Further, $ZnSO_4$, as constituent of essential enzymes, might significantly influence the biosynthesis of chlorophyll, nodulation, nitrogen fixation, pollen viability, seed setting, photosynthesis and translocation of assimilates towards sink. The result corroborated the finding of Verma *et al*. (2017). It was noticed that seeds/pod did not vary among INM options as that trait might be genetically governed. Altogether V_3N_5 produced highest yield attributes and yield (2601kg/ha) (pooled), while V_2N_1 produced lowest yield attributes and yield. YEZIN 15 was introduced from Myanmar and might therefore, show poor adaptation to Eastern Indian agro-climatic condition. Further, perhaps various losses of nutrients from fertilizer sources particularly during rainy season resulted in low soybean yield.

Seed oil and protein

Results in Table 3 revealed that both the quality parameters varied differently among the varieties. The highest oil content was registered by the seeds of V_2 (20.55%), while V_3 seeds ensured the highest protein (40.26%) (pooled). The lowest oil and protein contents were exhibited by the seeds of PS 24 and YEZIN 15, respectively. It might be due to specific genetic makeup of each variety as well as agro-climatic conditions of the harvest (Kumar *et al*., 2015). Although INM options did not vary significantly regarding soybean oil, but significant variations in protein were observed among them. Highest oil and protein contents were recorded from applications of N_1 and N_5, respectively and vice-versa. Specifically, highest oil (21.18%) and protein (40.98%) (pooled) were exhibited by V_2N_1 and V_3N_5, respectively. Synergistic effect of vermicompost and Zn along with

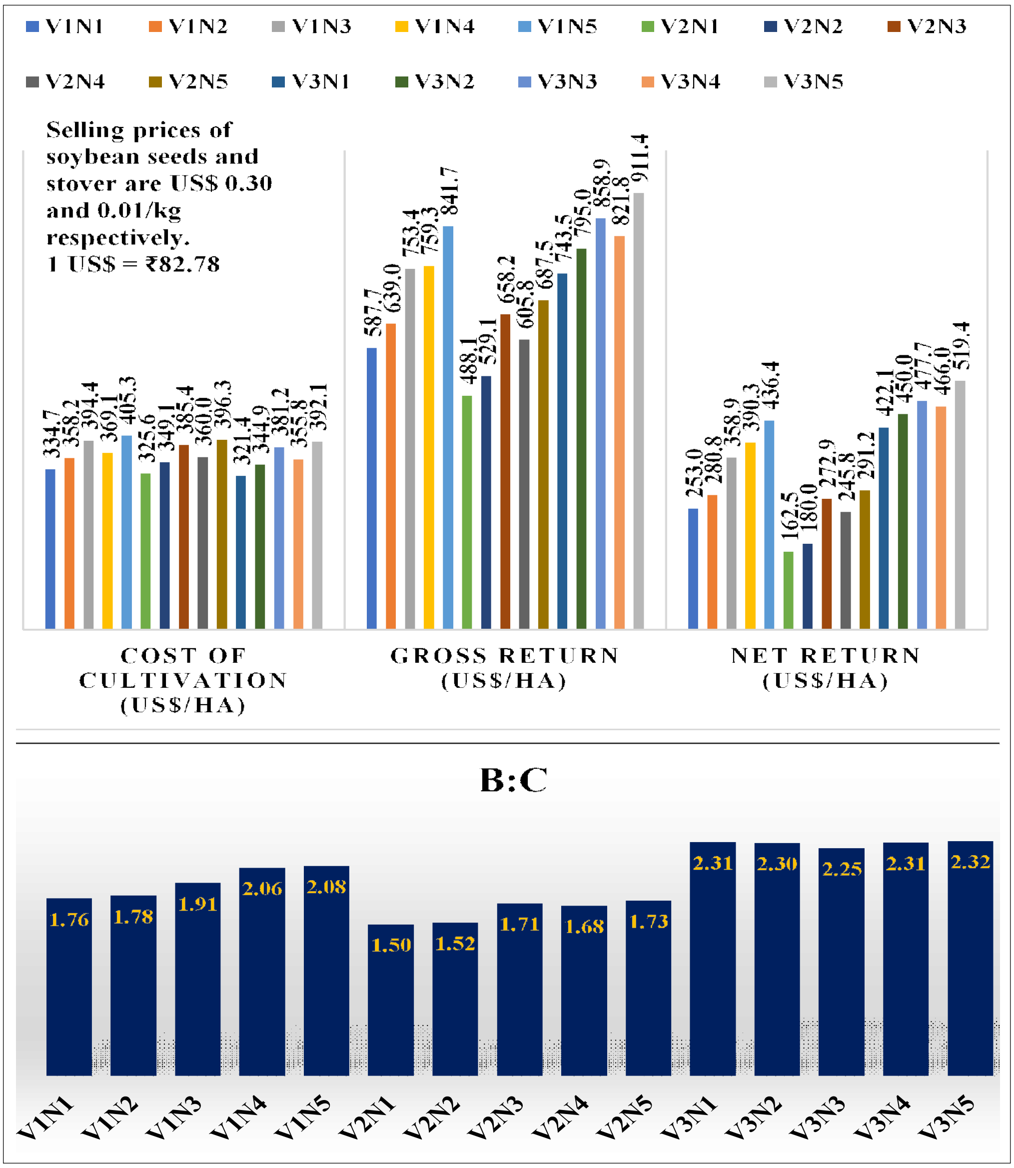

Fig 4: Effect of integrated nutrient management on production economics of soybean varieties.

inorganic NPK due to prolonged nutrient release and higher uptake of N, might accelerate protein synthesis (Verma *et al*., 2017). However, lower protein under N_1 might be due to antagonistic relation between fat and protein synthesis.

Relationship of seed yield with yield attributes and nodule numbers

Linear regression relationships existed between yield and (a) pods/plant, (b)100 seeds weight, (c) nodules/plant (Fig 2 a,b,c). Linear models were able to explain 99.06%, 91.24% and 96.94% variations between seed yield (a) pods/plant (R^2 = 0.9906), (b)100 seeds weight (R^2 = 0.9124), (c) nodules/plant (R^2 = 0.9694), respectively.

Energy sharing

It was found that irrespective of treatments, energies from indirect and non-renewable sources were more involved in soybean production than those from direct and renewable sources (Fig 3). Maximum energy was from indirect non-renewable sources. Application of N_4 consumed least energy from direct renewable (14.7%) and non-renewable (17.1%) sources as well as indirect renewable source (18.5%), but consumed maximum energy from indirect non-renewable source (49.7%), followed by application of N_5. Application of N_3 used least indirect non-renewable energy source (42.0%) and maximum energy from direct renewable (17.0%) and non-renewable (19.7%) sources as well as indirect renewable source (21.3%). It might be due to less uses of inorganic fertilizer (75% RDF) and organic manure (vermicompost) and no use of $ZnSO_4$, which were indirect non-renewable energy sources.

Energy indices

Irrespective of varieties, soybean consumed lowest and highest energy under applications of N_3 (6379.6 MJ) and N_4 (7352.1 MJ), respectively, showing its variations due to INM options (Table 4). Highest EO (112679.3 MJ), NEG (105777.2 MJ) and EP (1.14 kg/MJ) were recorded from V_3N_5. It might be due to direct and positive influence of yield on energy outcome (Ganajaxi *et al*., 2011). Highest ER and EPt as well as lowest SE (0.85 MJ/kg) were achieved from V_3N_3, followed by V_3N_5. It indicated less use of EI to generate higher yield or EO. Conversely, V_2N_1 recorded highest SE (1.34 MJ/kg) and lowest EO, NEG, ER, EP and EPt. It might be due to less productivity of that variety resulted from poor adaptability and loss of nutrients under 100% RDF in *kharif* season.

Economics

Economic analysis explored that V_3N_1 incurred lowest cost of cultivation (US$ 321.4/ha), while V_1N_5 required maximum cost (US$ 405.3/ha). N_1 required less cost due to less requirement of fertilizers as those were in concentrated form as compared to bulky organic manures used in other treatments. However, regarding gross (GR) and net returns (NR), V_3N_5 outperformed others (GR: US$ 911.4/ha and NR: US$ 519.4/ha), followed by V_3N_3 (GR: US$ 858.9/ha and NR: US$ 477.7/ha). Consequently, highest B:C (2.32) was ensured by V_3N_5, followed by V_3N_4 (2.31). Lowest GR (US$ 488.1/ha), NR (US$ 162.5/ha) and B:C (1.50) were recorded by V_2N_1. (Fig 4). The trend in economic return was possibly due to the yield variations exhibited by various treatment combinations.

CONCLUSION

The study confirmed the variable response of soybean varieties to different INM options. The result indicated that application of 75% RDF+1.5 t/ha vermicompost+25kg/ha $ZnSO_4$ was suitable for growing of soybean varieties, specially, 'PS 24' during *kharif* seasons of 2019 and 2020. Therefore, cultivation of soybean variety 'PS 24' under application of 75% RDF+1.5 t/ha vermicompost+25kg/ha $ZnSO_4$ can be recommended for achieving better nodulation, yield, quality, energy and economic outcomes in Eastern Indian condition.

Conflict of interst: None.

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