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Impact of nutrients from organic and inorganic sources on yield attributes, yield and quality in sesamum-pea cropping sequence in an acid Alfisol

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Abstract
This experiment was conducted at the Soil Microbiology section of Department of Soil Science, College of Agriculture, CSK HPKV, Palampur in pea and sesamum crop during *rabi*, 2008 and *kharif*, 2009.There were eight treatments with randomized block design (RBD). The soil was silty clay loam in texture, pH 5.2, cation exchange capacity 10.3 c mol (p^+) kg^{-1}, organic carbon 9.5 g kg^{-1}, available N and P (267.1 kg ha^{-1} and 10.2 kg ha^{-1}) during this study. The yield attributes and yield of both crops were recorded and an increase in number of pods per plant, grains per pod, green pod yield, vine yield, number of capsule per plant, grains per capsule, seed yield and stover yield and this increase was observed in those treatments where integration of organic and inorganic sources were applied. The highest yield and yield attributes were recorded in treatment T_6. Quality parameters were also recorded highest in treatment T_6.

Keywords: Balanced fertilization, biofertilizers, nitrogen fixers, phosphate solubilizers

Introduction
Plant growth under field conditions is one of the most complex, interactive amongst physical, chemical and biological systems. Crop yield is a function of soil, crop, climate and management factors. Amongst these factors, soil has edge over all others. The major emphasis on soil health, investigation until recently has been carried out the use of physical and chemical attributes of soil to define soil quality soil health (Arshad and Coen1992) [1]. The biological component of soil is responsible for humus formation, cycling of nutrient, soil tilth and structure and myriad of other functions (Tisdall 1991) [2]. These biological components have been largely ignored, though are an important aspect to manage sustainable agriculture, soil health and ecosystem. Thus, it is essential to maintain the physical, chemical and biological components of soil for sustainable agriculture. The maintenance of all these components together is essentially required with the use of organic inorganic and integration of organic, inorganic and biofertilizer together for restoration of declining soil productivity. Legumes-cereal cropping system is most common in our country because of the residual nitrogen from symbiosis benefits to the subsequent cereal crops (Tilak 1993) [3]. But the legume - oilseed cropping system is very uncommon. The yield and the area of legumes and oil seed crops are decreasing owing to their low yield and susceptibility towards insect pest and diseases.

Material and Methods
In order to achieve the objectives of the investigation a field study was conducted in pea and sesamum crop during *rabi*, 2008 and *kharif*, 2009 at the Soil Microbiology section of Department of Soil Science, College of Agriculture, CSK HPKV, Palampur. There were eight treatments which were replicated thrice in a randomized block design. The treatments were; (T_1): 10 t FYM ha^{-1} + NF (A) + PSB + CCR, (T_2): 10 t FYM ha^{-1} + NF (A) + PSB + CCR, (T_3): 5 t FYM ha^{-1} + NF (A) + P and K (RDF), (T_4): 5 t FYM ha^{-1} + NF (A) + PSB + Half N and P (RDF) + K (RDF), (T_5): 5 t FYM ha^{-1} + NF (B) + P and K (RDF), (T_6): 5 t FYM ha^{-1} + NF (B) + PSB + Half N and P (RDF) + K (RDF), (T_7): N, P and K (RDF), (T_8) Control. Recommended dose of fertilizer (RDF) rate corresponds to the state level recommendations for respective nutrients. FYM application was made @ 10 t ha^{-1} on fresh weight basis for both crops, which corresponds to the practice being followed by the farmers of the region. The FYM applied contained 60 per cent moisture; and its average nutrient content during the period of experimentation on dry weight basis was 1.01, 0.26 and 0.40 per cent of N, P and K, espectively in pea, nodule dry weight (mg) per plant was recorded at pre and post flowering stage.

Freshly harvested nodules were air dried for two days, and dried in an oven at 60 ± 5˚C till constant weight was obtained and grains per pod were recorded by picking five plants from every treatment plots and calculated the average. Green pod yield was recorded at every picking from each treatment and total yield of green pods were worked out by adding the yield obtained at every picking. After harvesting vines were kept for sun drying for 2-3 days and the vine yield was recorded by worked out their weight from every treatment plots.

In sesamum, numbers of capsules were recorded by selecting five plants each treatment and numbers of capsules were counted from each selected plant and calculated their average and grains per capsule were recorded by picking five capsules from the selected five plants from each treatment and calculated the average. The grains were extracted from the capsules and grain yield was recorded by worked out their weight from every treatment plots. After harvesting stover was left in plots kept for sun drying for 2-3 days and stover yield was calculated their weight from every treatment plots.

The grain samples of pea and sesamum were dried in an oven at 60 ^{0}C. The dried samples were then ground in grinder and pass through 1 mm sieve. The samples were then kept in paper bags for subsequent analysis. Protein content was determined by modified Micro-kjeldahl method (A.O.A.C. 1970) [4], crude fibre and oil content was determined by Soxhlet Extraction Heating Unit (AOAC. 1965) [5].

Results and Discussions

Yields attributes and yield of pea

Nodule Dry Weight: Nodule dry weight per plant differed significantly under different treatments. The highest nodule weight was recorded in T_2 (Organic treatment) and the lowest was recorded in T_7 (RDF). Amongst different treatments, organic treatments gave significantly higher nodule weight than control; chemical fertilizers applied and integrated treatments. Between organic treatments, T_2 found to be significantly better than T_1. It might be due to the Nitrogen fixer (B) who is isolate of Lahaul valley and performing better than Nitrogen fixer (A) in Palampur during winter season, because nitrogen fixing ability of individual depends on the influence of environment of the isolates and their symbiosis with their host. Results are corroborated with the findings of Giller (1990) [6]. Among the treatments T_6 and T_4 Treatment T_6 gave significantly higher nodule weight than Treatment T_3. It might be due to the application of nitrogen through chemical fertilizers alone. Nitrogen fertilizers suppress appearance and functioning of nodules. Similar results were reported by Pathak *et al.* (2005) [7] and Dubey and Bindra (2008) [8].

Table 1: Effect of organic and inorganic sources of nutrients on nodule dry weight, number of pods, grains per pod, pod yield and vine yield of pea.

Treatments	Nodule dry weight plant^{-1} (mg)	Number of pods plant^{-1}	Grains pod $^{-1}$
T_1:10 t FYM* ha $^{-1}$ + NF* (A) + PSB* + CCR*	15.4	12.7	5.2
T_2:10 t FYM ha $^{-1}$ + NF (A) + PSB + CCR	20.5	15.5	5.1
T_3:5 t FYM ha $^{-1}$ + NF (A) + P and K (RDF*)	6.40	17.8	5.4
T_4: 5 t FYM ha $^{-1}$ + NF (A) + PSB + Half N and P (RDF) + K (RDF)	8.70	23.5	5.8
T_5: 5 t FYM ha $^{-1}$ + NF (B) + P and K (RDF)	7.50	20.6	5.6
T_6: 5 t FYM ha $^{-1}$ + NF (B) + PSB + Half N and P (RDF) + K (RDF)	11.6	26.6	6.3
T_7: N, P and K (RDF)	4.60	16.2	4.9
T_8: Control	5.60	10.7	4.6
CD (P= 0.05)	0.02	2.40	0.40

(*NF: Nitrogen Fixer, *PSB: Phosphate solubilizers, *CCR: Chopped Cropped Residue, *RDF: Recommended Dose of Fertilizers)

Number of pods per plant

Pods were recorded under different treatment after grain filling stage per plant differed significantly. Under different treatments, treatment T_6 gave the highest number of pods per plant and the lowest number of pods per plant in control. Under integrated nutrient management treatments, substitution of 50 per cent nitrogen and phosphorus through organic and biofertilizers found to be better than the substitution of 50 per cent nitrogen with nitrogen fixing biofertilizers alone, along with recommended dose of phosphorus and potassium. Substitution of 50 percent nitrogen with nitrogen fixing biofertilizers alone, along with recommended dose of phosphorus gave numerically more number of pods per plant than the application of recommended dose of chemical fertilizers. Results are corroborated with the findings of Tyagi *et al*. (2003) [9] that composite application of *Rhizobium* and Phosphate solubilizing bacteria along with nitrogen and phosphorus gave higher yield attributes. Application of recommended dose of chemical fertilizers found to be statistically superior to the organic treatments T_1 and T_2.

Grains per pod

The effect of organic, inorganic and integrated sources of nutrients on grains per pod was significant. The treatment T_6 gave the highest number of grains per pod and the lowest in control. Between the organic treatments, T_1 gave numerically more number of grains per pod than T_2. Under integrated nutrient management treatments, substitution of 50 per cent nitrogen and phosphorus through organic and biofertilizers found to be better than the substitution of 50 per cent nitrogen with nitrogen fixing biofertilizers alone, along with recommended dose of phosphorus and potassium. Substitution of 50 percent nitrogen with nitrogen fixing biofertilizers alone, along with recommended dose of phosphorus gave numerically more number of grains per pod than the application recommended dose of chemical fertilizers. Application of recommended dose of chemical fertilizers found to be statistically inferior to the organic treatments. Results are corroborated with the findings of Tyagi *et al*. (2003) [9].

Green pod yield

Green pod yield under the different sources of nutrients differed significantly. The highest green pod yield was recorded in the treatment T_6 and the lowest green pod yield was recorded in the treatment T_8. Between the organic sources, treatment T_2 gave significantly higher green pod yield than T_1. Organic significantly superior to inorganic

Table 2: Effect of organic and inorganic sources of nutrients on green pod yield and vine yield of pea.

Treatments	Green Pod yield (q ha^{-1})	Vine yield (q ha^{-1})
T_1:10 t FYM ha $^{-1}$ + NF (A) + PSB + CCR	80.5	15.3
T_2:10 t FYM ha $^{-1}$ + NF (A) + PSB + CCR	88.8	15.5
T_3:5 t FYM ha $^{-1}$ + NF (A) + P and K (RDF)	95.2	15.7
T_4: 5 t FYM ha $^{-1}$ + NF (A) + PSB + Half N and P (RDF) + K (RDF)	102.5	18.8
T_5: 5 t FYM ha $^{-1}$ + NF (B) + P and K (RDF)	80.8	18.2
T_6: 5 t FYM ha $^{-1}$ + NF (B) + PSB + Half N and P (RDF) + K (RDF)	108.6	19.2
T_7: N, P and K (RDF),	64.7	17.6
T_8: Control	41.5	13.2
CD (P= 0.05)	1.80	0.27

(*NF: Nitrogen Fixer, *PSB: Phosphate solubilizers, *CCR: Chopped Cropped Residue, *RDF: Recommended Dose of Fertilizers)

sources of nutrient. Among all the treatments, treatments T_2 and T_1 registered 37.2 per cent and 24.4 per cent higher yield than treatment T_7 (inorganic sources of nutrients). Amongst integrated sources of nutrients, 50 percent substitution of nitrogen and phosphorus from organic and biofertilizers found to be significantly superior to substitution of 50 per cent nitrogen alone. Substitution of 50 per cent nitrogen and phosphorus from organic and biofertilizers found to be significantly superior to T_7 and organic sources of nutrients. Similar results were reported by Patel *et al.* (1998) [10] that the application of *Rhizobium* and Phosphate solubilizing bacteria substitute 50 per cent N and P and significantly improve green pod yield of pea. Results are corroborated with the findings Singh *et al.* (2006) [11].

Vine yield

The maximum vine yield was recorded in treatment T_6 followed by T_4, T_5, T_7, T_3, T_2 and T_1, respectively. Between organic treatments, T_2 gave numerically higher yield than T_1. Difference between treatment T_2 and T_1 is statistically at par. Treatment T_6 recorded 45.4 per cent higher vine yield than the control. Under integrated nutrient management treatments, substitution of 50 per cent nitrogen and phosphorus through organic and biofertilizers found to be better than the substitution of 50 percent nitrogen with nitrogen fixing biofertilizers alone, along with recommended dose of phosphorus. T_6 gave 2.12 per cent increase over T_4 All the treatments were significantly superior to control. Results are corroborated with findings of Rather *et al.* (2010) [12] who reported that application of biofertilizers increased the vine yield of pea.

Yield attributes and yield of sesamum

Number of capsule

Number of capsule under the different sources of nutrients differed significantly. The highest number of capsules was recorded in the treatment T_6 and the lowest number of capsules was recorded in the treatment T_8. Treatments T_1 and T_2 registered 5.97 per cent and 2.29 per cent higher yield than treatment T_7 (inorganic sources of nutrients). Substitution of 50 per cent nitrogen and phosphorus from organic and biofertilizers and substitution of 50 per cent nitrogen alone registered and 30.1, 23.1 and 9.66 per cent higher yield than the treatment T_7. It might be due to fact that the combined application of organic (FYM) and chemical fertilizers increased the yield attributes in sesamum. Similar results were also reported by Attia (2001) [13].

Grains per capsule

The results on grains per capsule as influenced by different Treatments have been given in table 4.2. The highest grains per capsule were recorded in the treatment T_6 and the lowest grains per capsule were recorded in control. Between the organic sources, treatment T_1 gave significantly higher grains per capsule than T_2. Organic treatments found to

Table 3: Effect of organic and inorganic sources of nutrients on number of capsule, grains per capsule

Treatments	Number of capsule plant^{-1}	Grains capsule^{-1}
T_1:10 t FYM ha $^{-1}$ + NF (A) + PSB + CCR	83.3	41.2
T_2:10 t FYM ha $^{-1}$ + NF (A) + PSB + CCR	80.4	39.4
T_3:5 t FYM ha $^{-1}$ + NF (A) + P and K (RDF)	84.9	40.3
T_4: 5 t FYM ha $^{-1}$ + NF (A) + PSB + Half N and P (RDF) + K (RDF)	96.8	41.8
T_5: 5 t FYM ha $^{-1}$ + NF (B) + P and K (RDF)	86.2	41.5
T_6: 5 t FYM ha $^{-1}$ + NF (B) + PSB + Half N and P (RDF) + K (RDF)	102.3	43.5
T_7: N, P and K (RDF),	78.6	40.6
T_8: Control	65.3	38.4
CD (P= 0.05)	2.94	1.26

(*NF: Nitrogen Fixer, *PSB: Phosphate solubilizers, *CCR: Chopped Cropped Residue, *RDF: Recommended Dose of Fertilizers)

be significantly inferior to inorganic sources of nutrients. Treatment T_7 was found to be significantly superior to treatment T_8 and significantly inferior than T_6, and T_4. Substitution of 50 percent nitrogen and phosphorus from organic and biofertilizers registered 2.9 and 7.1 per cent higher yield than the treatment T_7. It might be due to fact that cumulative effect of organic and inorganic source of nutrients resulted in an increase yield attributes. Results are corroborated with the findings of Habbasha *et al.* (2007)

Seed yield

Seed yield under the different sources of nutrients differed significantly. The highest seed yield was recorded in the treatment T_6 and the lowest seed yield was recorded in control. Inorganic treatment found to be significantly superior to organic sources of nutrient. Treatments T_2 and T_1 registered 2.43 and 10.5 per cent lower yield than treatment T_7 (inorganic sources of nutrients). It might be due to that the application of nutrients through chemical sources provided

the readymade sources of nutrients which caused immediate availability of nutrients to crop, whereas the organic sources of nutrient supply less and continuous nutrient which may not fulfill the nutrients requirement of crops at particular stage and latter on it may be lost owing to continuous mineralization of nutrients. Results are corroborated with the findings of Ashfaq-Ahmad *et al.* (2001) [14]. Among all the treatments, treatments T_6 and T_4 were found statistically at par with each other. Results are corroborated with the findings of Attia (2001) [13] and Habbasha *et al*. (2007) [15]

Table 4: Effect of organic and inorganic sources of nutrients on seed yield, stover yield of sesamum

Treatments	Seed yield (q ha $^{-1}$)	Stover yield (q ha^{-1})
T_1:10 t FYM ha $^{-1}$ + NF (A) + PSB + CCR	3.8	5.7
T_2:10 t FYM ha $^{-1}$ + NF (A) + PSB + CCR	4.1	6.1
T_3:5 t FYM ha $^{-1}$ + NF (A) + P and K (RDF)	4.3	6.4
T_4: 5 t FYM ha $^{-1}$ + NF (A) + PSB + Half N and P (RDF) + K (RDF)	4.8	7.2
T_5: 5 t FYM ha $^{-1}$ + NF (B) + P and K (RDF)	4.6	6.9
T_6: 5 t FYM ha $^{-1}$ + NF (B) + PSB + Half N and P (RDF) + K (RDF)	5.1	7.6
T_7: N, P and K (RDF),	4.2	6.1
T_8: Control	3.4	5.1
CD (P= 0.05)	0.34	0.38

(*NF: Nitrogen Fixer, *PSB: Phosphate solubilizers, *CCR: Chopped Cropped Residue, *RDF: Recommended Dose of Fertilizers)

Stover yield

The effect of organic, inorganic and integrated sources of nutrients on stover yield was differed significantly. The maximum stover yield was recorded in T_6 and minimum in T_8. The treatment T_6 recorded 49.01 per cent higher stover yield than the control. Between organic treatments, T_2 gave higher stover yield than T_1. Under integrated nutrient management treatments, substitution of 50 per cent nitrogen and phosphorus through organic and biofertilizers found to be better than the substitution of 50 percent nitrogen with nitrogen fixing biofertilizers alone, along with recommended dose of phosphorus. T_6 gave 5.5 per cent increase over T_4. Similar results were reported by Habbasha *et al.* (2007) [15] that cumulative effect of organic and inorganic sources of nutrients increased straw and biological yield of sesamum. All the treatments were found significantly superior to control.

Quality of pea and sesamum

Pea

Protein content: The results were revealed that protein content differed significantly under different treatments. The highest protein content was recorded in T_6 and the lowest were recorded in control. Between organic treatments, T_2 gave numerically high protein content than T_1. Positive response of rhizobial inoculation may cause to increase the nitrogen concentration which resulted high protein content. Similar results were reported by Dubey and Bindra (2008) [8]. Amongst integrated sources of nutrients, T_6 gave higher protein content over T_5. Integrated nutrients management gave significantly higher protein content than control, chemical fertilizers and organic treatments. Integrated use of nutrients might have increased the concentration of nitrogen in plants that resulted higher protein content in the treatments where nitrogen and phosphorus and only nitrogen were integrated with organics, inorganic and chemical fertilizers than that the organic and inorganic alone. Results are corroborated with the findings of Sharma and Rana (1993) [16]. The treatment T_7 was found to be significantly superior to treatment T_8. Increased in the doses of nitrogen resulted to increase nitrogen content of green pod and ultimately protein content in pod. Results are corroborated with the findings of Dubey and Bindra (2008) [8].

Crude fibre content

Crude fibre content under the different sources of nutrients differed significantly. The highest crude fibre content was recorded in the treatment T_6 and the lowest crude fibre content was recorded in control. Between the organic sources, treatment T_2 gave significantly higher crude fibre content than T_1. Inorganic treatment found to be significantly superior to organic sources of nutrient. Treatments T_2 and T_1 registered 22.29 and 43.9 per cent lower crude fibre content than treatment T_7. Amongst integrated sources of nutrients, T_6 gave 3.07 per cent over T_5 and T_4 gave 17.3 per cent increase over T_3.

Table 5: Effect of organic and inorganic sources of nutrients on protein, crude fibre and oil content in pea

Treatments	Protein content (%)	Crude fibre content (%)	Oil content (%)
T_1:10 t FYM* ha $^{-1}$ + NF* (A) + PSB* + CCR*	20.2	0.41	1.70
T_2:10 t FYM ha $^{-1}$ + NF (A) + PSB + CCR	20.3	0.48	1.78
T_3:5 t FYM ha $^{-1}$ + NF (A) + P and K (RDF*)	21.8	0.52	1.80
T_4: 5 t FYM ha $^{-1}$ + NF (A) + PSB + Half N and P (RDF) + K (RDF)	22.1	0.61	2.13
T_5: 5 t FYM ha $^{-1}$ + NF (B) + P and K (RDF)	22.3	0.64	2.44
T_6: 5 t FYM ha $^{-1}$ + NF (B) + PSB + Half N and P (RDF) + K (RDF)	22.8	0.67	2.53
T_7: N, P and K (RDF)	20.4	0.59	2.09
T_8: Control	19.4	0.38	1.69
CD (P= 0.05)	0.94	0.04	0.06

(*NF: Nitrogen Fixer, *PSB: Phosphate solubilizers, *CCR: Chopped Cropped Residue, *RDF: Recommended Dose of Fertilizers)

Oil content

The results on oil content as influenced by different treatments. Oil content under the different sources of nutrients differed significantly. The highest oil content was recorded in the treatment T_6 and the lowest oil content was recorded in the treatment T_8. Between the organic sources, treatment T_2 gave significantly higher oil content than T_1. Organic treatments found to be significantly inferior to inorganic sources of

nutrients. Amongst integrated sources of nutrients, T_6 gave highest oil content than T_5. Substitution of 50 per cent nitrogen and phosphorus from organic and biofertilizers found to be significantly superior to T_7, and organic sources of nutrients. Amongst integrated sources of nutrients, T_6 gave 3.7 per cent over T_5 and T_4 gave 18.3 per cent increase over T_3. Similar results were reported by Habbasha *et al.* (2007) [15].

Sesamum

Protein content: The data revealed that protein content differed significantly under different treatments. Between organic treatments, T_2 gave numerically high protein content than T_1. Amongst integrated sources of nutrients, T_6 gave higher protein content over T_5. Integrated nutrients practices gave significantly higher protein content than control, chemical fertilizers and organic treatments. Treatment T_6 was found statistically at par with Treatment T_5. It might be due to that organic source and integration of organic and inorganic sources improve soil nutrient plant supply system which resulted to increase the nutrient contents in crops which ultimately improves the quality parameters of the crops. Duhoon *et al.* (2010) [17] reported that use of bionatural input increase the protein, crude fibre and oil content. Treatment T_7 was found to be significantly superior to treatment T_8 and significantly inferior than T_6.

Table 6: Effect of organic and inorganic sources of nutrients on protein, crude fibre and oil content in sesamum

Treatments	Protein content (%)	Crude fibre content (%)	Oil content (%)
T_1:10 t FYM* ha $^{-1}$ + NF* (A) + PSB* + CCR*	18.9	2.6	51.8
T_2:10 t FYM ha $^{-1}$ + NF (A) + PSB + CCR	19.1	2.7	52.5
T_3:5 t FYM ha $^{-1}$ + NF (A) + P and K (RDF*)	19.4	2.9	53.6
T_4: 5 t FYM ha $^{-1}$ + NF (A) + PSB + Half N and P (RDF) + K (RDF)	12.03	3.1	54.1
T_5: 5 t FYM ha $^{-1}$ + NF (B) + P and K (RDF)	19.9	3.3	53.8
T_6: 5 t FYM ha $^{-1}$ + NF (B) + PSB + Half N and P (RDF) + K (RDF)	20.5	3.5	54.5
T_7: N, P and K (RDF)	19.3	2.8	53.3
T_8: Control	18.6	2.5	51.2
CD (P= 0.05)	0.34	0.14	0.61

(*NF: Nitrogen Fixer, *PSB: Phosphate solubilizers, *CCR: Chopped Cropped Residue, *RDF: Recommended Dose of Fertilizers)

Crude fibre content

Crude fibre content under the different sources of nutrients differed significantly. Between the organic sources, treatment T_2 gave numerically higher crude fibre content than T_1. Inorganic treatment gave numerically high crude fibre content than organic sources of nutrient. It might be due to that organic source and integration of organic and inorganic sources improve soil nutrient plant supply system which resulted to increase the nutrient contents in crops which ultimately improves the quality parameters of the crops. Duhoon *et al.* (2010) [17] reported that use of bionatural input increase the protein, crude fibres and oil content. Amongst integrated sources of nutrients, substitution of 50 per cent nitrogen and phosphorus from organic and biofertilizers found to be significantly superior to substitution of 50 per cent nitrogen alone. Treatment T_6 registered significantly more crude fibre content than T_5, T_4 and T_3, respectively. Treatment T_6 gave 6.06 per cent over T_5 and treatment T_4 gave 6.89 per cent increase over T_3.Treatment T_7 was found to be significantly superior to treatment T_8 and significantly inferior than T_6, T_5, and T_4. Treatment T_7 gave 25, 17.8, 10.7 and 3.57 per cent decrease over T_6, T_5, T_4 and T_3, respectively.

Oil content

The results on oil content as influenced by different treatments. Oil content under the different sources of nutrients differed significantly. The highest oil content was recorded in the treatment T_6 and the lowest oil content was recorded in control. Between the organic sources, treatment T_2 gave significantly higher oil content than T_1. Amongst integrated sources of nutrients, substitution of 50 per cent nitrogen and phosphorus from organic and biofertilizers found to be significantly superior to substitution of 50 per cent nitrogen alone T_6 gave more oil content than T_5. Substitution of 50 per cent nitrogen and phosphorus from organic and biofertilizers found to be significantly superior to T_7 and organic sources of nutrients. These results obtained might be due to organic source and integration of organic and inorganic sources improve soil nutrient plant supply system which resulted to increase the nutrient contents in crops which ultimately improves the quality parameters of the crops. Duhoon *et al.* (2010) [17] reported that use of bionatural input increase the protein, crude fibres and oil content.

Conclusion

- The yield attributes and yield of pea and sesamum crop were recorded highest where organic sources (FYM), inorganic sources (Half N and P and full K (RDF) and bio fertilizers (Nitrogen Fixer (B) + Phosphate Solubilizers) were applied.
- Quality parameters were also improved where the conjunctive use of organics and inorganic were applied but were found maximum in treatment where organics, inorganic and biofertilizers were applied in pea-sesamum cropping sequence.

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