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Growth, yield and quality of Indian mustard [*Brassica juncea* (L.) Czern. & Coss.] influence by integrated nutrient management

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Abstract

Experiment was conducted at Agricultural Research Farm Dhablan of the G.S.S.D.G.S. Khalsa college Patiala, Punjab. The experiment was laid out in randomized block design with 3 replications and 13 treatment combination of integrated nutrient Management. The soil of experimental field was clay in texture with pH 7.2 and contained organic carbon 0.80%, available nitrogen 374 kg/ha, available phosphorus 30.32 kg/ha and available K 120 kg/ha. All nutrients were applied in basal dose at one day before sowing. The crop was sown on 20th October, 2015. Application of Integrated nutrient Management significantly influenced the number plant height (cm) number of leaves plant⁻¹ number of branches plant⁻¹ fresh and dry weight (g) plant⁻¹. The highest seed yield was recorded with the application of T₇ (100% RDF + 2 t FYM ha⁻¹ + 20 kg S ha⁻¹ + 20 kg ZnSO₄ ha⁻¹ + 1 t vermicompost ha⁻¹ + Azotobacter Seed treatment) was found significantly higher over rest treatments.

Keywords: Indian mustard, integrated nutrient management, dry weight

Introduction

The oilseed crop *Brassica* are the third important edible oil sources after groundnut and soyabean, accounting for over 13.2 per cent of world's edible oil supply. Mustard is a major oilseed crop of India, it grown in tropical and temperate zones. They occupy a prominent place being next in importance to groundnut, both in area and production, meeting the fat requirement of about 50 percent population in India. It grown well from an altitude of 650-1500 meters, it require warm weather 20 °C during seed germination, 15 °C - 20 °C during plant growth and long sunny bright days 25 °C - 27 °C at flowering and pod formation are most suitable for these crops. Mustard grow best under relatively cool temperatures upto flowering. These crops grow profusely at 30-60% relative humidity. Oilseeds have prestigious place in Indian agriculture next only to cereals. India is blessed with favourable agro-ecological conditions for the growth of wide range of cultivated, perennial and annual oilseeds. Oilseeds are the most important crops in India both in respect of remunerative return per unit area and wider adaptability under constrained agro-climatic conditions. In India, mustard and rapeseed are the second most important oilseed crops after groundnut contributing about 30 per cent of total oilseeds production [2]. In India Oilseeds crop are cultivated on 26.82 million ha area with 31.1 million tonnes production (2010-11). The average yield of oil seeds crop in India is 1159 kg /ha.

Materials and Methods

The present investigation entitles "Growth, Yield and quality of Indian Mustard [*Brassica juncea* (L.) Czern. & Coss.] Influence by Integrated Nutrient Management" was conducted during *rabi* season of 2015-2016 at the Agricultural Research Farm Dhablan is situated at about 24-46 °N latitude and 76-24 °E longitude at an altitude of about 250 m above the mean sea level. The experiment was laid out in randomized block design with 3 replications. From the five randomly selected plants the heights were recorded in cm. The numbers of branches were counted from the sample plants and the values of these were averaged. To study the fresh and dry weight of five plants were collected from the sampling rows of each plot at 30 days interval from sowing till harvest of the crop. These fresh samples were air dried and then dried in an oven at 60 °C till a constant weight was obtained and weighed to record the average dry weight of the plant.

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The weight of the sun dried harvested crop was recorded from net plot area and expressed in quintal per hectare after subtracting the seed yield. Seed yield of each plot excluding the border and sampling row was weighed in kilo gram and converted into quintal per hectare.

Result and Discussion

Data recorded on plant height increase consistently with the advancement of crop age and reached its maximum at maturity and thereafter a small change was observed. INM sources of nutrients significantly influenced the plant height at all the stages of crop growth. A critical increase plant height in data indicated was maximum between 30 DAS and 60 DAS but slowed down between 90 DAS and at harvest. similar results was also reported by Thaneshwar *et al.* 2017 [1] Premi *et al.* [3] in Indian mustard.

During the early stage of growth (30 DAS) branches were found to be absent. At the succeeding stages, the number of branch increased significantly with increasing levels. Marked variation in primary branched plant⁻¹ was also observed due to different INM level. The data revealed that the highest primary branches plant⁻¹ was recorded T₇ (100% RDF + 2 t FYM ha⁻¹ + 20 kg S ha⁻¹ + 20 kg ZnSO₄ ha⁻¹ + 1 t vermicompost ha⁻¹ + Azotobacter Seed treatment) at all the stage of crop growth.

Integrated nutrient management significant influence on dry weight content of plants. Among all the INM sources of nutrients, the application of different plant nutrients increases dry weight at all growth stases due to high photo synthesis rate which are recorded in T₇ (100% RDF + 2 t FYM ha⁻¹ + 20 kg S ha⁻¹ + 20 kg ZnSO₄ ha⁻¹ + 1 t vermicompost ha⁻¹ + Azotobacter Seed treatment) at par with T₆ (100% RDF + 2 t FYM ha⁻¹ + 20 kg S ha⁻¹ + 20 kg ZnSO₄ ha⁻¹ + 1 t vermicompost ha⁻¹) at various stages of observation.

Stover yield increased with increasing fertilizer dose levels of INM treatment seven gives better response as comparison to other treatments. The higher stover yield with the application of INM can be attributed to better growth of the plant as expressed in terms of plant height, number of branch plant⁻¹, fresh and dry weight of plant all above character responsible for stover yield. This finding is also supported by Singh and Kanajua 2009 [6], Anand *et al.* 2009 [7], Mandal 2006 *et al.* [4]

in Indian mustard. The seed yield was affected by INM application. Such a positive yield response of INM application is obvious when it is limiting in the growing medium. Application of INM therefore provides better nutrition to Indian Mustard which resulted in higher seed yield. Increased in seed yield with the application of INM may be due to better growth of the plant as expressed in term of plant height, fresh. higher seed yield with the application of INM. This finding is also supported by Ramesh *et al.* [8] in Indian mustard.

Maximum oil content (39.65%) was obtained with in T₇ (100% RDF + 2 t FYM ha⁻¹ + 20 kg S ha⁻¹ + 20 kg ZnSO₄ ha⁻¹ + 1 t vermicompost ha⁻¹ + Azotobacter Seed treatment) which were statistically at par recorded in T₆ (100% RDF + 2 t FYM ha⁻¹ + 20 kg S ha⁻¹ + 20 kg ZnSO₄ ha⁻¹ (38.38%) which significantly superior to rest of all the treatments. Maximum protein content (20.98%) was obtained with in T₇ (100% RDF + 2 t FYM ha⁻¹ + 20 kg S ha⁻¹ + 20 kg ZnSO₄ ha⁻¹ + 1 t vermicompost ha⁻¹ + Azotobacter Seed treatment) which were statistically at par recorded in T₆ (100% RDF + 2 t FYM ha⁻¹ + 20 kg S ha⁻¹ + 20 kg ZnSO₄ ha⁻¹ (20.31%) which significantly superior to rest of all the treatments. This finding is also supported by Tripathi *et al.* (2011) [9]

Table 1: Effect of INM on plant height (cm) of Indian mustard at different stages of crop growth

Treatment	30 DAS	60 DAS	90 DAS	120DAS
T ₁	16.13	29.13	84.47	85.93
T ₂	19.27	35.13	87.87	90.20
T ₃	19.40	36.17	88.20	90.20
T ₄	20.53	38.00	89.57	91.57
T ₅	22.63	38.37	91.00	93.00
T ₆	23.60	45.10	91.87	93.87
T ₇	25.10	45.90	100.13	102.80
T ₈	19.20	32.90	86.63	88.63
T ₉	22.20	37.73	87.40	89.40
T ₁₀	22.47	36.93	88.70	90.70
T ₁₁	22.80	34.83	89.40	91.40
T ₁₂	23.03	37.53	89.27	91.27
T ₁₃	23.40	43.20	90.13	92.13
Mean	21.52	37.77	89.59	91.62
SE(d)±	NS	1.75	0.89	1.03
CD (5%)	5.94	3.96	2.00	2.33

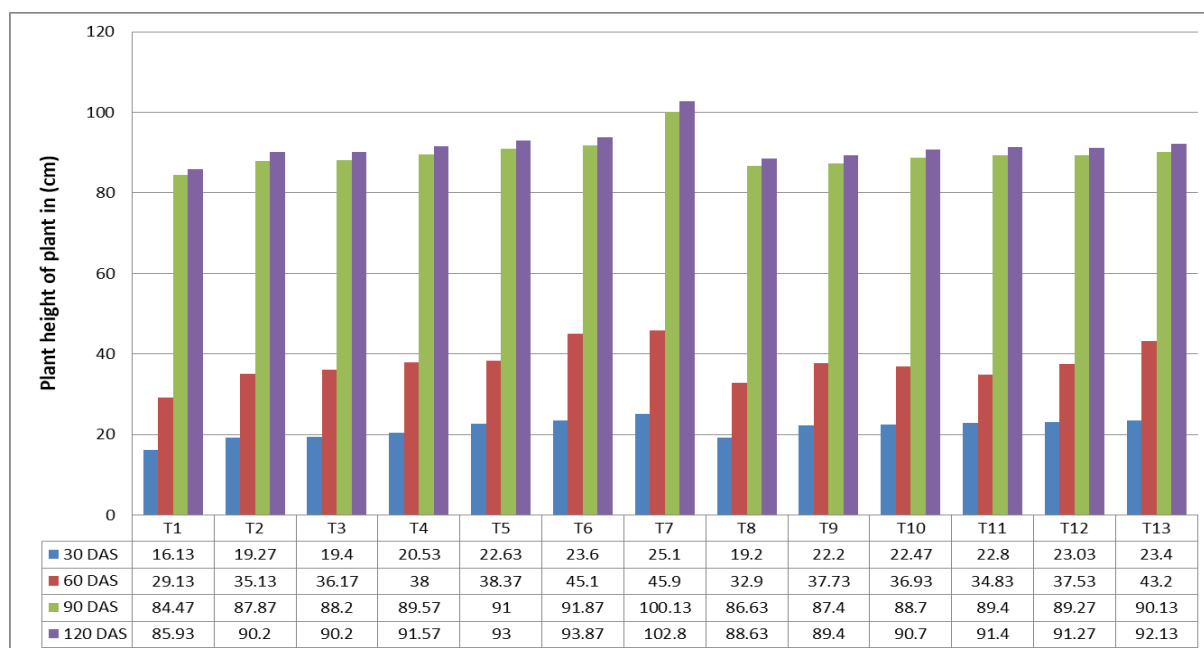
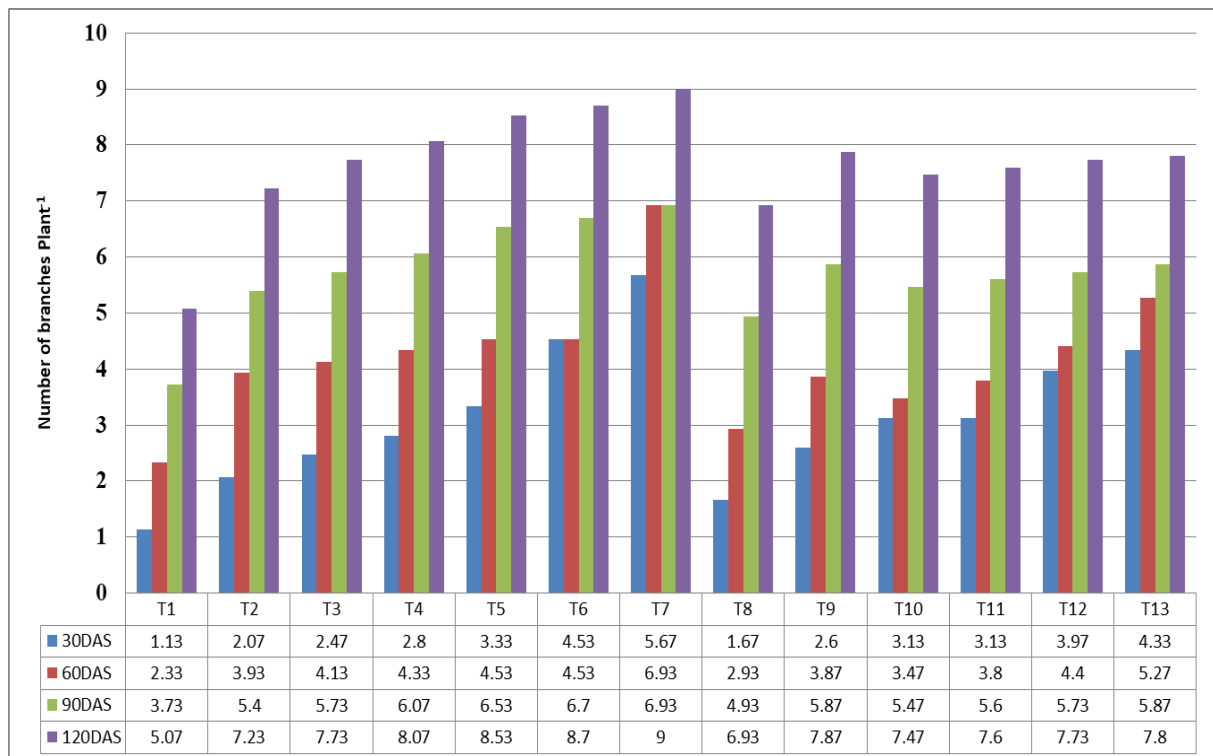


Fig 1: Effect of INM on plant height (cm) of Indian mustard

Table 2: Effect of INM on number of branches of Indian mustard at different stages of crop growth

Treatment	30 DAS	60 DAS	90 DAS	120DAS
T ₁	1.13	2.33	3.73	5.07
T ₂	2.07	3.93	5.40	7.23
T ₃	2.47	4.13	5.73	7.73
T ₄	2.80	4.33	6.07	8.07
T ₅	3.33	4.53	6.53	8.53
T ₆	4.53	4.53	6.70	8.70
T ₇	5.67	6.93	6.93	9.00
T ₈	1.67	2.93	4.93	6.93
T ₉	2.60	3.87	5.87	7.87
T ₁₀	3.13	3.47	5.47	7.47
T ₁₁	3.13	3.80	5.60	7.60
T ₁₂	3.97	4.40	5.73	7.73
T ₁₃	4.33	5.27	5.87	7.80
Mean	3.14	4.19	5.74	7.67
SE(d)±	NS	1.28	0.88	0.69
CD (5%)	6.21	2.89	1.98	1.56

**Fig 2:** Effect of INM on number of branches plant⁻¹ of Indian mustard**Table 3:** Effect of INM on dry weight (g plant⁻¹) of Indian mustard at different stages of crop growth

Treatment	30 DAS	60 DAS	90 DAS
T ₁	1.40	8.33	29.73
T ₂	1.65	9.77	31.60
T ₃	2.17	9.53	31.67
T ₄	3.51	9.73	33.20
T ₅	2.57	9.87	35.45
T ₆	2.90	9.20	43.27
T ₇	4.30	9.60	45.20
T ₈	2.16	7.93	36.07
T ₉	2.75	8.67	31.23
T ₁₀	1.73	8.80	32.93
T ₁₁	2.49	8.80	34.59
T ₁₂	1.51	9.40	34.79
T ₁₃	2.93	8.87	36.29
Mean	2.47	9.11	35.08
SE(d)±	1.23	0.95	1.48
CD (5%)	2.79	2.14	3.34

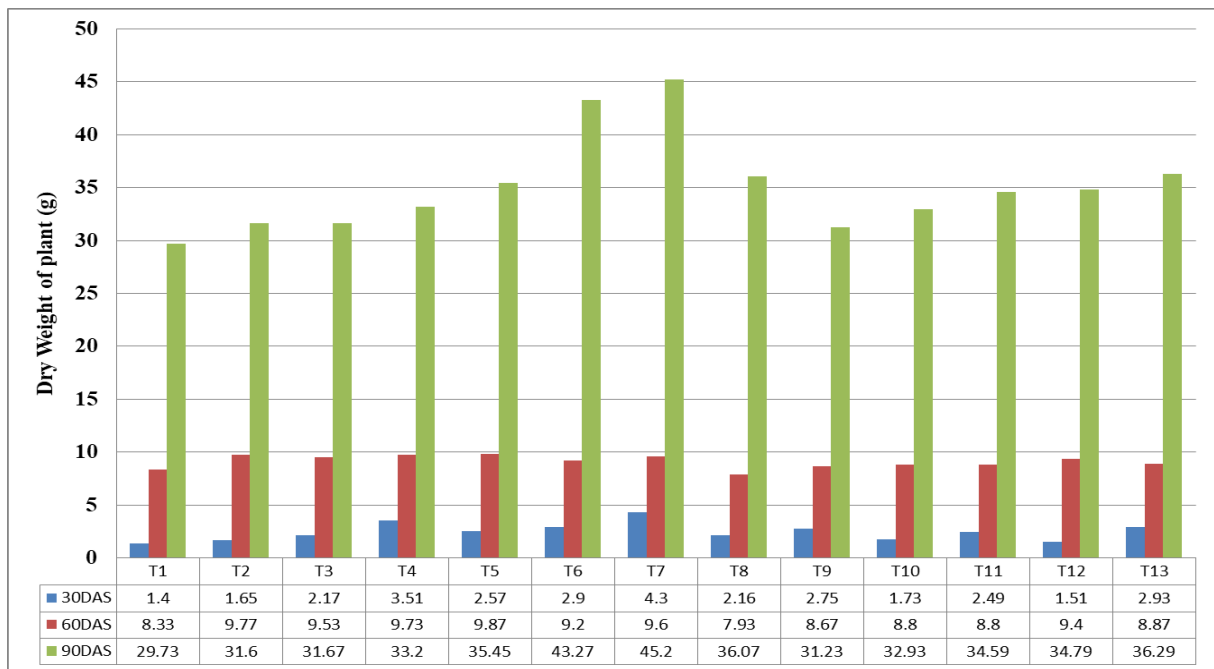


Fig 3: Effect of INM on dry weight (g) of Indian mustard

Table 4: Effect of INM on stover and seed yield (q ha⁻¹) of Indian mustard

Treatment	Stover Yield	Seed Yield q ha ⁻¹
T ₁	11.37	9.07
T ₂	14.37	17.37
T ₃	15.27	19.27
T ₄	16.73	22.73
T ₅	19.40	24.07
T ₆	19.77	25.10
T ₇	24.27	26.93
T ₈	13.53	15.10
T ₉	17.73	17.40
T ₁₀	18.07	20.50
T ₁₁	21.27	22.60
T ₁₂	22.87	23.50
T ₁₃	24.40	25.05
Mean	18.39	20.66
SE(d)±	1.86	0.34
CD (5%)	4.19	0.76

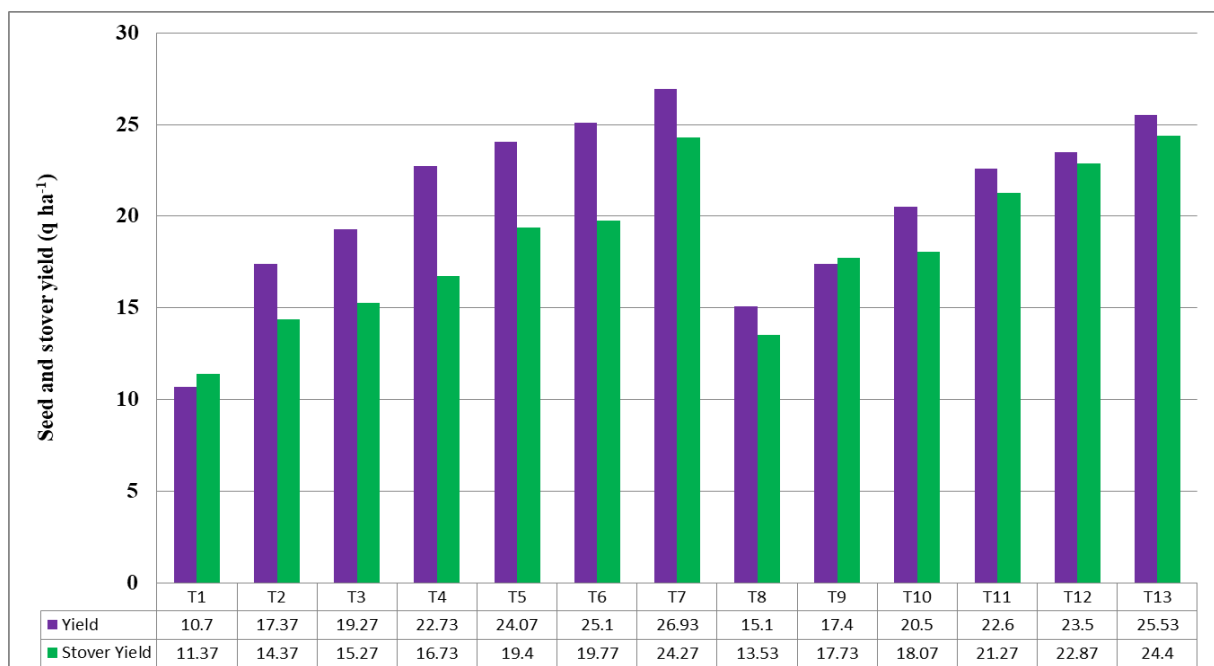
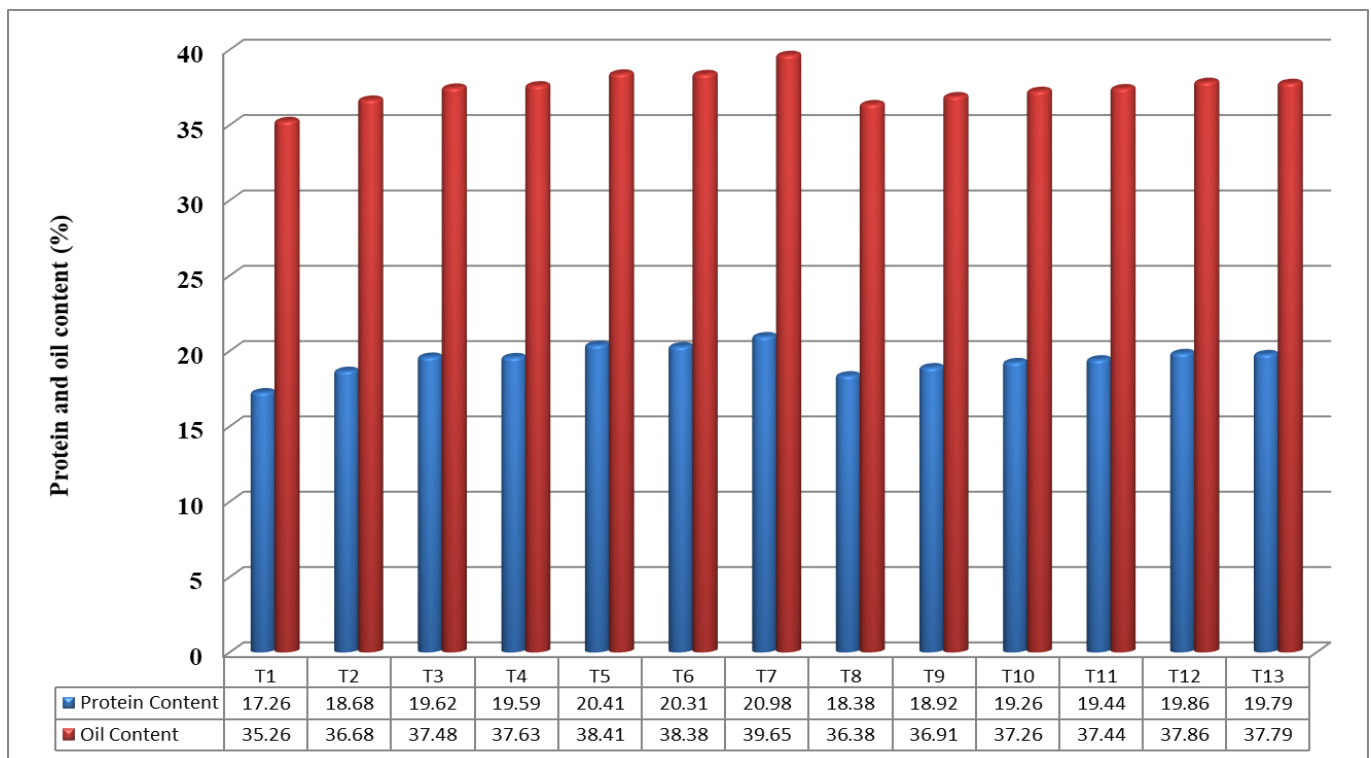


Fig 4: Effect of INM on stover and seed yield (q ha⁻¹) of Indian mustard

Table 5: Effect of INM on protein and oil content of Indian mustard

Treatment	Protein Content	Oil Content
T ₁	17.26	35.26
T ₂	18.68	36.68
T ₃	19.62	37.48
T ₄	19.59	37.63
T ₅	20.41	38.41
T ₆	20.31	38.38
T ₇	20.98	39.65
T ₈	18.38	36.38
T ₉	18.92	36.91
T ₁₀	19.26	37.26
T ₁₁	19.44	37.44
T ₁₂	19.86	37.86
T ₁₃	19.79	37.79
Mean	19.42	37.47
SE(d)±	0.24	0.26
CD (5%)	0.54	0.59

**Fig 5:** Effect of INM on Quality of Indian mustard

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