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Effect of integrated nutrient management on growth attributing characters of crops under various oat-lathyrus intercropping system

S Biswas, K Jana, RK Agrawal and AM Puste

Abstract
One field experiment was conducted at Central Research Farm, Gayeshpur, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal during *rabi* season of 2015-16 and 2016-17 to evaluate the effect of integrated nutrient management on various growth attributes of oat and lathyrus under different cereal-legume based cropping system. The experiment was placed in split plot design with 3 replications comprising 4 levels of cropping system (CS_1-Sole oat, CS_2-Sole lathyrus, CS_3 - Intercropping of oat with lathyrus in 3:2 row ratio and CS_4 -Intercropping of oat with lathyrus in 3:3 row ratio) in the main plot and 4 levels of nutrient management (N_1 - Full RDF through inorganic source, N_2 - 75% N through urea + rest N through FYM, N_3 - 75% N through urea + rest N through vermicompost and N_4 -75% N through urea + rest N through mustard oilcake) in the sub plot. Results revealed that maximum vegetative growths in terms of plant height (99.4 cm and 57.8 cm), leaf area index (4.20 and 1.94), root length (11.6cm and 15.5 cm) and weight (7.42 g and 0.409 g) were recorded for both oat and lathyrus respectively, during 1st and 2nd year of experimentation (pooled value of 2 years) when 75% N through urea + rest N through vermicompost was applied. Oat performed better under 3:3 intercropping system due to the advantage of biological nitrogen fixation while, sole lathyrus showed highest performance compared to their other cropping situations.

Keywords: Growth attributes, integrated nutrient management, intercropping, lathyrus, Oat

Introduction
Livestock is a great resource of India. Beside agriculture, livestock too plays a pivotal role towards enhancing country's economic status. People from rural areas are involved in different enterprises of agriculture and animal husbandry. India, being a developing country is still unable to provide sufficient quantities of food to its ever increasing population. Malnutrition, starvation, hunger, poverty etc. are firy examples of this situation. The livestock productivity in India is also far below the world average due to considerable gap between the requirement and availability of green fodder. Cultivation of fodder crops is paid less attention as most of the agricultural land is devoted to food crops for meeting food demand of our enormous population and as a result, livestock productivity of the country is suffering. Beside, continuous cultivation of food crops using inorganic sources of nutrients from same field invites soil quality deterioration and environmental issues. Under these circumstances, in order to increase livestock productivity and also for betterment of soil health, cultivation of fodder crops through integrating both organic and inorganic nutrient sources is very much required. Oat (*Avena sativa* L.) is one such fodder crop, grown in winter season with the advantages of highly nutritious, bulk amount of fodder as rations for poultry, cattle, sheep and other animals (Verma *et al*., 2016) [13] and can be fed in any form - green forage, silage or hay-covering some scarcity periods of the year. Its green forage quantity as well as quality is a consequence of its vegetative growth behaviour, which is enhanced by balanced form of nitrogen application (Singh and Dubey, 2007) [10], especially through integrated nutrient management (INM). Intercropping, a multi prolonged 'Intensive cropping' approach to increase the production with the benefit of better utilization of land, erosion reduction, subsistence to farmers during years of chances of main crop failure, soil fertility and crop productivity enhancement. Cereal-legume based intercropping is always found superior over sole cropping and other types of cropping system due to additional effect of biological nitrogen fixation. Among leguminous crops, lathyrus (*Lathyrus sativus*), an annual, winter growing crop, can be included in intercropping to support cereal crop production successfully. Though, its cultivation is limited due to neurotoxin BOAA, it can support farmers during lean period and vegetative portion of

this crop can be a nutritious fodder source for the livestock. As supply of fodder sufficiently to the animals directly depends on vegetative growth of the crops, the following research was proposed to find out how vegetative growth attributes of oat and lathyrus vary with integrated nutrient management under various cropping system.

Materials and methods

The field experiment was placedinsplit-plot design with three replications comprising 4 levels of cropping system (CS_1-Sole oat, CS_2-Sole lathyrus, CS_3 - Intercropping of oat with lathyrus in 3:2 row ratio andCS_4- Intercropping of oat with lathyrus in 3:3 row ratio)in the main plot and 4 levels of nutrient management (N_1 - Full RDF through inorganic source, N_2 - 75% N through urea + rest N through FYM, N_3 - 75% N through urea + rest N through vermicompost and N_4 - 75% N through urea + rest N through mustard oilcake) in the sub plot at Central Research Farm, Gayeshpur, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal (23°N latitude, 89°E longitude and 9.75 m above mean sea level (MSL) and medium land in topography) in last week of November (*rabi* season) of 2015-16 and 2016-17.The soil was sandy loam in texture, neutral in reaction (pH 6.75), low in available N (196.5 kg/ha), high in available P (47.2 kg/ha), medium in available K (198.4 kg/ha) and organic carbon (0.51%).The variety 'OS-6' for oat @ 100 kg/ha, 70 kg/ha, 57 kg/ha and 'Ratan' (Bio L 212) for lathyrus @50 kg/ha, 15kg/ha, 20 kg/ha were used in sole cropping, 3:2 and 3:3 intercropping systems, respectively. Recommended doses of fertilizers (RDF) were 80 kg N, 60 kg P_2O_5 and 40 kg K_2O/ha for sole oat and for both intercropping systems and 20 kg N, 40 kg P_2O_5 and 30 kg K_2O/ha for sole lathyrus. Basal applications of 50% N, full quantities of P_2O_5 and K_2O were made from urea (25% N), organic manures like FYM, vermicompost, mustard oilcake (25% N), S.S.P. and M.O.P., respectively. Rest 50% N was equally top dressed at 25 days after basal application and 61 days after sowing (DAS) through urea. Plot size was 4 m x 3 m. One cutting was made in oat crop to obtain green forage for livestock at 60DAS. Observations include plant height, leaf area index, root length and root weight of both oat and lathyrusat a periodic interval of 30 days. The data recorded from the field was statistically analysed through the analysis of variance method (Goulden, 1952 and Cochran and Cox, 1959) [6, 2] and treatment means were compared following critical differences (CD) suggested by Gomez and Gomez (1984) [5] for significance at 5%.

Results and Discussion

Growth attributing characters of oat

Effect of different levels of cropping system on growth attributing characters of oat

From the pooled results it was found that at 30 days after sowing (DAS) there was no significant effect of different levels of cropping system on plant height, LAI, root length and root weight of oat. The highest plant height (32.7 cm), Leaf Area Index (LAI) (2.83), root length (4.56 cm) and root weight (0.89 g) were observed in intercropping system of oat and lathyrus at 3:3 row ratios (CS_4). It was because of that in early stage of the plant growth, all the plants got sufficient amount of light for photosynthesis and there was no severe competition for nutrient and water among crops as development of roots were less. From 60 DAS onwards up to 120 DAS (at harvest) plant height, LAI, root length and root weight differed significantly with cropping systems due to the effect of biological nitrogen fixation by lathyrus. At 60 DAS highest plant height (89.1 cm), Leaf Area Index (LAI) (4.14), root length (7.90 cm) and root weight (3.32 g) were recorded in intercropping system of oat and lathyrus at 3:3 row ratios (CS_4) followed by 3:2 intercropping system of oat and lathyrus (CS_3) and sole oat (CS_1) (Table 1). Pooled value obtained at $CS_4$was statistically at par with CS_3 in terms of plant height whereas CS_1 was statistically at par with CS_3 in terms of LAI and root weight. Significant difference in growth characters might be due the transfer of nitrogen fixed biologically by lathyrus to cereal crop oat in intercropping systems. Eaglesham *et al.* (1981) [3] also confirmed with the result when they found that in Sub-Saharan Africa nitrogen fixed by component legume crop cowpea was available to associated cereal maize in current growing season. At 90 DAS intercropping system of oat and lathyrus at 3:3 row ratios (CS_4) was found best in terms of plant height (52.9 cm), Leaf Area Index (LAI) (3.88), root length (9.24 cm) and root weight (6.54 g) of oat. Pooled value obtained at $CS_1$was statistically at par with CS_3 which was again statistically at par with CS_4 in terms of LAI. Plant height and LAI were curtailed down because at 60 DAS a cutting was done to obtain green forage yield and the crop had to regenerate again. But plant roots still remained inside the soil which caused competition for nutrients and water. In 3:3 intercropping system of oat and lathyrus (CS_4), oat got additional benefit of more biological nitrogen fixation by lathyrus as compared to sole oat (CS_1) where no biological nitrogen fixation occurred and 3:2 intercropping system (CS_3) where biological nitrogen fixation was comparatively less. At 120 DAS (at harvest) highest plant height (98.2 cm),Leaf Area Index (LAI) (4.07), root length (11.6 cm) and root weight (6.82 g) were obtained in intercropping system of oat and lathyrus at 3:3 row ratios (CS_4) followed by 3:2 intercropping system of oat and lathyrus (CS_3) and sole oat (CS_1) (Fig 1, 2, 3, 4). Plant height and root weight in CS_3were statistically at par with CS_1 while LAI in CS_4 was statistically at par with CS_3. The results were in conformity with the findings of Adesoji *et al.* (2013) [1] in maize crop. LAI of oat was lowest in case of sole oat (CS_1) probably due to the absence of leguminous crop lathyrus which could have provided huge amount of nitrogen to the soil through biological nitrogen fixation and helped the oat to obtain more leaf area in intercropping systems. Under sole cropping, more plant population might be another reason for obtaining lowest Leaf Area Index (LAI) as the competition for light was more there. Prasad and Brook (2005) [8] also reported high LAI in case of maize under soybean intercropping over sole crops.

Effect of different levels of nutrient management on growth attributing characters of oat

At 30 DAS there was also no significant effect of different levels of nutrient management on plant height, LAI, root length and root weight of oat. The highest plant height (33.3 cm), Leaf Area Index (LAI) (2.81), root length (4.56 cm) and root weight (0.90 g) were recorded in 75% N through urea + rest N through vermicompost (N_3) followed by75% N through urea + rest N through mustard oilcake (N_4), 75% N through urea + rest N through FYM (N_2) and full RDF through inorganic source (N_1). However, from 60 DAS to 120 DAS (harvest) significant variation occurred in plant height, LAI, root length and root weight of oat with different levels of nutrient management. Highest plant height (88.7 cm), Leaf Area Index (LAI) (4.20), root length (7.86 cm) and root

weight (3.95 g) were observed at 60 DAS in 75% N through urea + rest N through vermicompost (N_3) followed by 75% N through urea + rest N through mustard oilcake (N_4), 75% N through urea + rest N through FYM (N_2) and full RDF through inorganic source (N_1). Pooled value obtained at N_4 was statistically at par with N_3in terms of plant height, LAI and root length while N_1 was statistically at par with N_2 in terms of plant height and LAI of oat. LAI and root weight from treatment N_2 were statistically at par with treatment N_4.75% N through urea + rest N through vermicompost (N_3) gave highest result because here integration of organic manure in the form of vermicompost with inorganic fertilizer was done. Vermicompost gave quick responses and acted as excellent base for beneficial microbes and plant growth regulators. Positive role of vermicompost in nutrient availability has already been reported by Vasanthi and Kumaraswamy (1996) [12]. At 90 DAS highest plant height (53.7 cm), Leaf Area Index (LAI) (3.88), root length (9.22 cm) and root weight (6.84 g) were noticed in 75% N through urea + rest N through vermicompost (N_3) followed by 75% N through urea + rest N through mustard oilcake (N_4), 75% N through urea + rest N through FYM (N_2) and full RDF through inorganic source (N_1). Pooled value obtained at N_1 was statistically at par with N_2 in terms of plant height, LAI and root length of oat. N_1 was also statistically at par with N_4 in terms of LAI while N_2 and N_4 were statistically at par with N_3 in terms of LAI and root length of oat. N_2 was also statistically at par with N_3 in terms of root length of oat. During harvest (at 120 DAS)75% N through urea + rest N through vermicompost (N_3) again proved to be the best with plant height (99.4 cm), Leaf Area Index (LAI) (4.08), root length (11.6 cm) and root weight (7.42 g) of oat followed by 75% N through urea + rest N through mustard oilcake (N_4), 75% N through urea + rest N through FYM (N_2) and full RDF through inorganic source (N_1) (Table 1) ((Fig 1, 2, 3, 4). Pooled value obtained at $N_2$was statistically at par with N_4whichwas again statistically at par with N_3whereas $N_1$was statistically at par with N_2in terms of plant height, LAI and root length of oat. $N_1$was statistically at par with N_4 in terms of plant height and with N_2 in terms of root weight while $N_2$was statistically at par with N_3 in terms of root length of oat. This result was in agreement with the research outcomes of Puneeth Raj and Vyakaranahal (2014) [9] in oat variety 'OS-6' where they found best results in terms of growth characters when they incorporated vermicompost with inorganic nutrient sources. Thakral *et al.* (2001) [11] also confirmed about the beneficial effect of vermicompost as a part of INM on growth and yield of pearl millet.

Growth attributing characters of lathyrus

Effect of different levels of cropping system on growth attributing characters of lathyrus

Experimental results pooled over 2 years revealed that at 30 DAS there was no significant effect of different levels of cropping system on plant height, LAI, root length and root weight of lathyrus. However, highest plant height (16.1 cm), Leaf Area Index (LAI) (0.95), root length (6.55 cm) and root weight (0.071 g) were reported from the sole lathyrus (CS_2) (Table 2). It was because of that in early stage of plant growth there was no shading effect. The root growth and root depth of plant was less and thus there was no severe competition for light, nutrient and water among crops. Growth characters of lathyrus varied significantly among cropping systems from 60 DAS up to harvest (120 DAS) at a periodic interval of 30 days. At 60 DAS highest plant height (37.8 cm), Leaf Area Index (LAI) (1.91), root length (11.8 cm) and root weight (0.143 g) of lathyrus were obtained from sole lathyrus (CS_2) followed by 3:3 intercropping system of oat and lathyrus (CS_4) and 3:2 intercropping system of oat and lathyrus (CS_3). It might be due to maximum biological nitrogen fixation by lathyrus under sole crop situation. 3:3 intercropping system of oat and lathyrus (CS_4) was statistically at par with sole lathyrus (CS_2) in terms of LAI and root length of lathyrus. At 90 DAS sole lathyrus (CS_2) again exhibited highest plant height (49.6 cm), Leaf Area Index (LAI) (1.63), root length (13.8 cm) and root weight (0.348 g) of lathyrus followed by 3:3 intercropping system of oat and lathyrus (CS_4) and 3:2 intercropping system of oat and lathyrus (CS_3). It was because of that although at 60 DAS a cutting was done in case of oat to obtain green forage yield and oat crop had to regenerate again, plant roots still remained inside the soil which caused inter-crop competition for nutrients and water in both intercropping systems. Pooled value obtained at CS_4 was statistically at par with CS_3 in terms of plant height as there was no shading effect in both intercropping systems due to cutting of oat at 60 DAS for green forage and with CS_2 in terms of LAI of lathyrus. Finally, at harvest (120 DAS) also highest plant height (57.8 cm), Leaf Area Index (LAI) (1.34), root length (15.1 cm) and root weight (0.39 g) of lathyrus were recorded in the sole lathyrus (CS_2) followed by 3:3 intercropping system of oat and lathyrus (CS_4) and 3:2 intercropping system of oat and lathyrus (CS_3)(Fig 5, 6, 7, 8). Pooled value obtained at CS_4 was statistically at par with CS_2 and CS_3 in terms of LAI of lathyrus. Plant height, LAI and root growth of lathyrus were highest in case of sole lathyrus (CS_2) perhaps due to the fact that under sole cropping system although intra crop competition occurred, there was no inter competition with cereal crop oat, but in case of intercropping system there was competition for water, nutrient between two crops which made the differences in those growth characters since oat had high requirements of those resources. Besides, shading effect of oat on lathyrus might be another cause for limited expression of growth characters of lathyrus in both the intercropping systems. Fan *et al.* (2018) [4] almost similarly reported that shading of maize affected various growth characters of soybean in maize-soybean relay strip intercropping system. 3:3 intercropping system of oat and lathyrus (CS_4) got more space, air, sunlight as compared to 3:2 intercropping system of oat and lathyrus (CS_3) which inflect better plant height and LAI of lathyrus. Among the two intercropping system biological nitrogen fixation was more in case of 3:3 intercropping system of oat and lathyrus (CS_4) which could be another reason for attaining better plant height, leaf area and root growth than 3:2 intercropping system of oat and lathyrus (CS_3).

Effect of different levels of nutrient management on growth attributing characters of lathyrus

On the other hand, different levels of nutrient management also exhibited no significant effect on plant height, LAI, root length and root weight of lathyrus at 30 DAS. However, highest plant height (16.3 cm), Leaf Area Index (LAI) (0.95), root length (6.55 cm) and root weight (0.074 g) were observed in 75% N through urea + rest N through vermicompost (N_3). But from 60 DAS onwards growth characters of lathyrus differed significantly with different levels of nutrient management. At 60 DA Shighest plant height (36.3 cm), Leaf Area Index (LAI) (1.94), root length (12.0 cm) and root

weight (0.15 g) were noticed in 75% N through urea + rest N through vermicompost (N_3) followed by 75% N through urea + rest N through mustard oilcake (N_4), 75% N through urea + rest N through FYM (N_2) and full RDF through inorganic source (N_1). Pooled value obtained at treatment N_1 was statistically at par with treatments N_2 and N_4 in terms of plant height and root weight of lathyrus. Pooled value obtained at N_4treatment was statistically at par with N_3 in terms of plant height, LAI and root weight of lathyrus. N_2 was statistically at par with N_3 in terms of plant height and root weight while it was statistically at par with N_4 in terms of root weight of lathyrus. Treatment N_1 was statistically at par with treatment N_2 in terms of root length of lathyrus. At 90 DAS highest plant height (49.5 cm), Leaf Area Index (LAI) (1.67), root length (14.0 cm) and root weight (0.369 g) were again recorded in 75% N through urea + rest N through vermicompost (N_3) followed by 75% N through urea + rest N through mustard oilcake (N_4), 75% N through urea + rest N through FYM (N_2) and full RDF through inorganic source (N_1) (Table 2). During harvesting (at 120 DAS) also highest plant height (57.8 cm), Leaf Area Index (LAI) (1.35), root length (15.5 cm) and root weight (0.409 g) were obtained from 75% N through urea + rest N through vermicompost (N_3) followed by 75% N through urea + rest N through mustard oilcake (N_4), 75% N through urea + rest N through FYM (N_2) and full RDF through inorganic source (N_1)(Fig 5, 6, 7, 8). LAI and root length of lathyrus from treatment N_4 were statistically at par with those from treatment N_3. Pooled value obtained at treatment N_1 was statistically at par with treatment N_2 in terms of root length of lathyrus. Both at 90 and 120 DAS plant height and root weight of lathyrus from treatment N_1 was statistically at par with those from treatments N_2 and N_4. Treatments N_2 and N_4 were statistically at par with each other and also with treatment N_3 in terms of plant height and root weight of lathyrus at 90 and 120 DAS. Thus, growth characters of lathyrus were also improved by vermicompost which was a part of INM. Kumari and Kumari (2002) [7] too reported the positive impact of vermicompost under INM on cowpea.

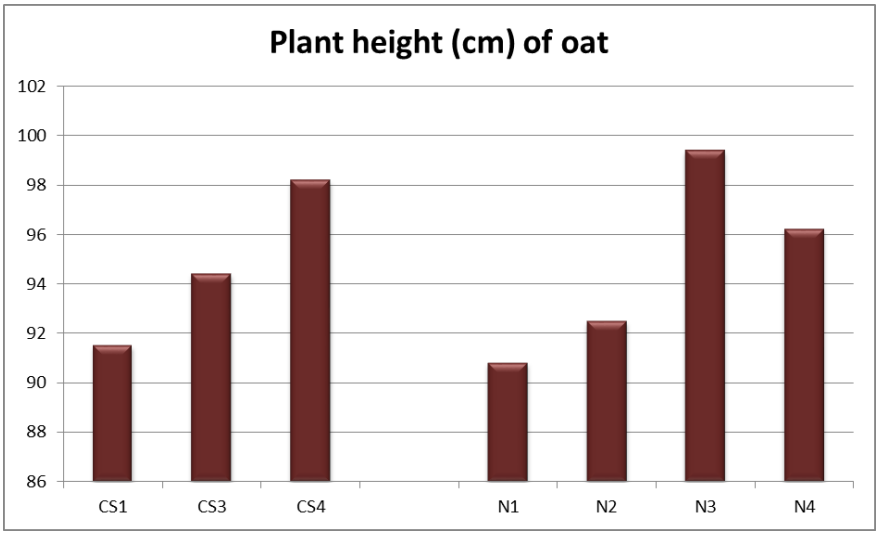

Fig 1: Effect of cropping system and nutrient management on plant height of oat at harvest (120 DAS)

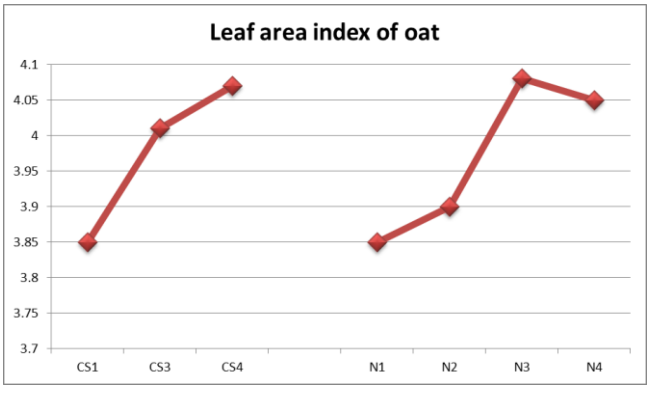

Fig 2: Effect of cropping system and nutrient management on Leaf area index (LAI) of oat at harvest (120 DAS)

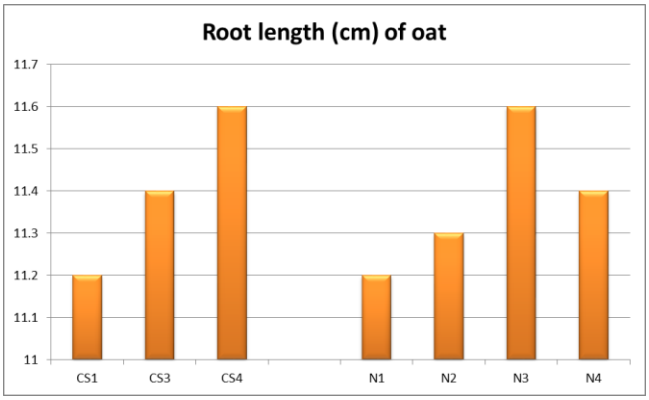

Fig 3: Effect of cropping system and nutrient management on root length of oat at harvest (120 DAS)

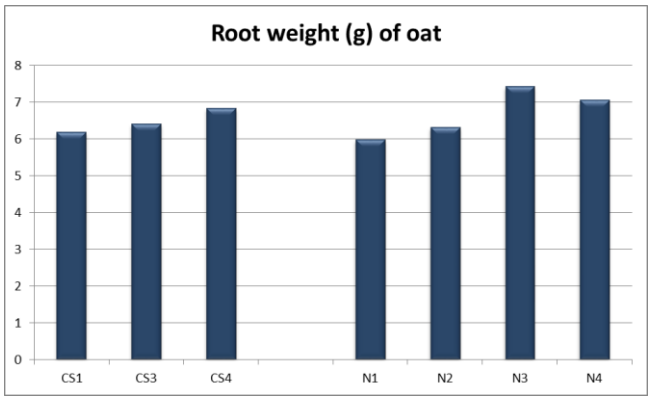

Fig 4: Effect of cropping system and nutrient management on root weight of oat at harvest (120 DAS)

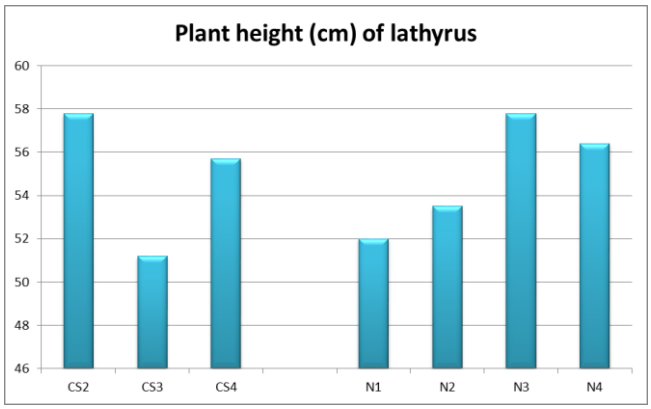

Fig 5: Effect of cropping system and nutrient management on plant height of lathyrus at harvest (120 DAS)

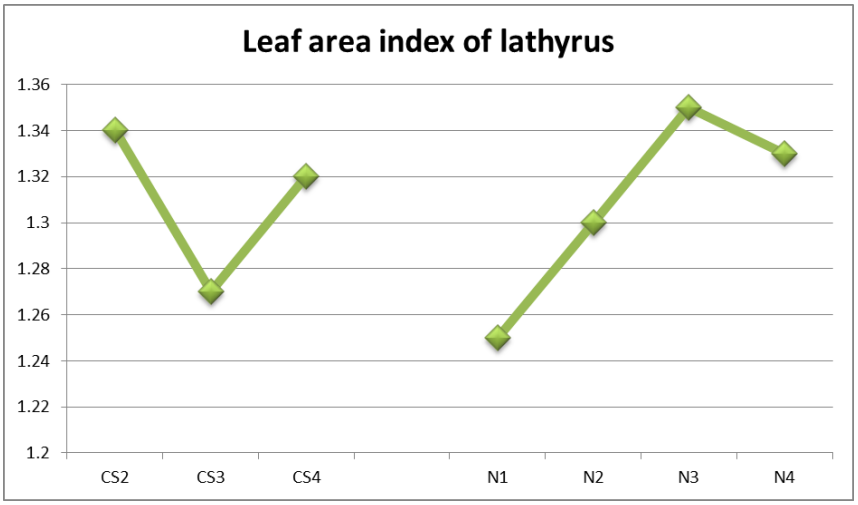

Fig 6: Effect of cropping system and nutrient management on Leaf area index (LAI) of lathyrus at harvest (120 DAS)

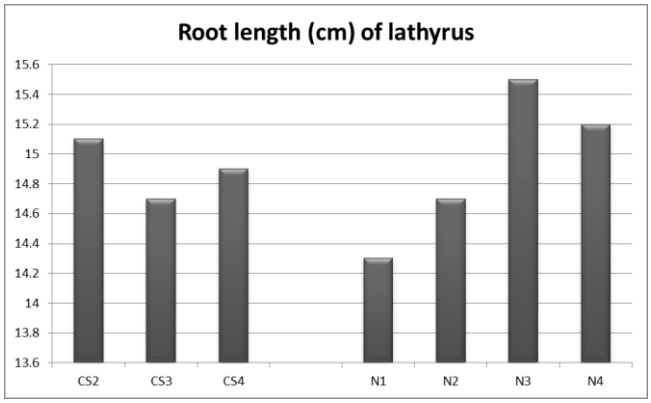

Fig 7: Effect of cropping system and nutrient management on root length of lathyrus at harvest (120 DAS)

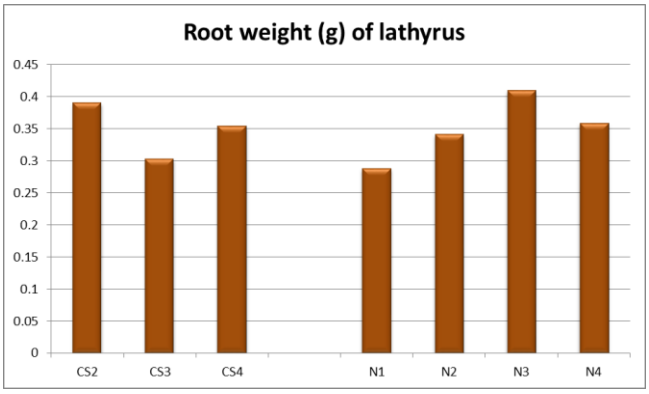

Fig 8: Effect of cropping system and nutrient management on root weight of lathyrus at harvest (120 DAS)

Table 1: Effect of different levels of cropping system and nutrient management on growth attributing characters of oat (Pooled of 2 years)

Treatment	Plant height (cm)				Leaf Area Index (LAI)				Root length (cm)				Root weight (g)			
	30 DAS	60 DAS	90 DAS	120 DAS	30 DAS	60 DAS	90 DAS	120 DAS	30 DAS	60 DAS	90 DAS	120 DAS	30 DAS	60 DAS	90 DAS	120 DAS
Levels of cropping system (CS)																
CS_1	31.7	73.7	47.1	91.5	2.78	4.01	3.78	3.85	4.50	7.20	8.88	11.2	0.88	2.94	5.97	6.18
CS_3	32.2	85.6	50.4	94.4	2.81	4.08	3.83	4.01	4.54	7.64	9.06	11.4	0.88	3.08	6.23	6.41
CS_4	32.7	89.1	52.9	98.2	2.83	4.14	3.88	4.07	4.56	7.90	9.24	11.6	0.89	3.32	6.54	6.82
S.Em (±)	0.39	0.95	0.48	0.83	0.02	0.02	0.01	0.02	0.09	0.05	0.04	0.05	0.03	0.07	0.06	0.08
CD (p=0.05)	NS	3.8	1.9	3.3	NS	0.07	0.05	0.09	NS	0.22	0.15	0.2	NS	0.27	0.25	0.32
Levels of nutrient management (N)																
N_1	31.4	78.1	47.8	90.8	2.77	3.96	3.76	3.85	4.50	7.30	8.88	11.2	0.87	2.82	5.21	5.98

N_2	31.5	80.5	48.5	92.5	2.79	4.02	3.83	3.90	4.54	7.44	9.02	11.3	0.88	3.36	5.89	6.31
N_3	33.3	88.7	53.7	99.4	2.81	4.20	3.88	4.08	4.56	7.86	9.22	11.6	0.90	3.95	6.84	7.42
N_4	32.6	83.9	50.5	96.2	2.80	4.13	3.84	4.05	4.54	7.70	9.12	11.4	0.89	3.45	6.42	7.05
S.Em (±)	0.69	1.86	0.95	2.12	0.02	0.05	0.04	0.05	0.07	0.11	0.09	0.10	0.02	0.12	0.13	0.12
CD (p=0.05)	NS	5.5	2.8	6.3	NS	0.14	0.11	0.16	NS	0.33	0.27	0.3	NS	0.35	0.39	0.36

Table 2: Effect of different levels of cropping system and nutrient management on growth attributing characters of lathyrus (Pooled of 2 years)

Treatment	Plant height (cm)				Leaf Area Index (LAI)				Root length (cm)				Root weight (g)			
	30 DAS	60 DAS	90 DAS	120 DAS	30 DAS	60 DAS	90 DAS	120 DAS	30 DAS	60 DAS	90 DAS	120 DAS	30 DAS	60 DAS	90 DAS	120 DAS
Levels of cropping system (CS)																
CS_2	16.1	37.8	49.6	57.8	0.95	1.91	1.63	1.34	6.55	11.8	13.8	15.1	0.071	0.143	0.348	0.390
CS_3	15.7	31.8	42.9	51.2	0.91	1.82	1.53	1.27	6.52	11.1	12.9	14.7	0.060	0.104	0.248	0.303
CS_4	15.9	34.3	46.2	55.7	0.92	1.87	1.60	1.32	6.53	11.6	13.1	14.9	0.063	0.119	0.293	0.354
S.Em (±)	0.19	0.60	0.86	0.49	0.008	0.01	0.02	0.01	0.03	0.08	0.03	0.03	0.005	0.003	0.010	0.011
CD (p=0.05)	NS	2.4	3.4	2.0	NS	0.04	0.07	0.05	NS	0.3	0.1	0.1	NS	0.013	0.039	0.045
Levels of nutrient management (N)																
N_1	15.6	33.2	42.2	52.0	0.89	1.75	1.50	1.25	6.51	11.0	12.5	14.3	0.067	0.101	0.218	0.288
N_2	15.8	34.5	45.6	53.5	0.92	1.85	1.56	1.30	6.53	11.3	13.0	14.7	0.053	0.117	0.270	0.341
N_3	16.3	36.3	49.5	57.8	0.95	1.94	1.67	1.35	6.55	12.0	14.0	15.5	0.074	0.150	0.369	0.409
N_4	15.9	34.6	46.4	56.4	0.94	1.92	1.61	1.33	6.54	11.6	13.6	15.2	0.063	0.121	0.328	0.358
S.Em (±)	0.34	0.83	1.42	1.60	0.02	0.02	0.01	0.02	0.01	0.10	0.12	0.11	0.012	0.014	0.044	0.037
CD (p=0.05)	NS	2.5	4.2	4.8	NS	0.04	0.04	0.05	NS	0.3	0.4	0.3	NS	0.046	0.132	0.109

Conclusion

Experimental pooled results of two years established that growth characters of both cereal (oats) and legume crop (lathyrus) are influenced by various intercropping and integrated nutrient management. Among different nutrient management options 75% nitrogen through urea and 25% nitrogen from vermicompost can be used to obtain best results in growth characters of both oat and lathyrus. 3:3 intercropping system of oat and lathyrus proved to be the best system for achieving maximum growth of oat while growth of lathyrus excellent under sole crop situation due to the impact of biological nitrogen fixation.

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