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Abstract
A field experiment entitled “Integrated nutrient management in fodder oat + Lathyrus intercropping system” was carried during Rabi 2017-18 at forage research field situated at Ranchi veterinary college campus of Birsa Agricultural University, Kanke, Ranchi. The experiment was laid out in Split-plot Design with three replications. Total 12 treatment combinations were taken from four intercropping system viz. Sole oat, sole lathyrus, oat+lathyrus (3:2) and oat + lathyrus (3:3) in main plot and three integrated nutrient management(100 % RDF as Inorganic, 50% N of RDF + 50% N of RDF (FYM) and 50% N of RDF+ 50% N of RDF (V. Comp) under sub plot. The highest green fodder yield of sole fodder oat at 100 % RDF as inorganic was 368.34 q ha⁻¹, while sole lathyrus at 100 % RDF (inorganic) produced (137.33 qha⁻¹) geen fodder which was at par with sole lathyrus (136.67 qha⁻¹) at 50% N of RDF (inorganic) + 50 % N of RDF (vermicompost). Total maximum green fodder yield under sole oat (368.34 q/ha) at 100 % RDF (inorganic) and 363.34 q/ha at 50% N of RDF (inorganic) + 50% N of RDF (vermicompost) under oat+lathyrus (3:2) were at par with each other.

Keywords: Green fodder yield, nutrient management, oat

Introduction
The Animal Husbandry and livestock sectors are critical for the rural economy, especially the small and marginal farmers. They not only contribute to their income but also their best insurance against any natural calamity. The livestock sector alone contributes nearly 25.6% of Value of Output at current prices of total value of output in Agriculture, Fishing & Forestry sector. The overall contribution of Livestock Sector in total GDP is nearly 4.11%at current prices during 2012-13 (19th Animal Census, 2012). Livestock sector of Jharkhand among the newly created state reserved their position and became a key component of the diversified agricultural system through upliftment of rural economy by providing gainful employment opportunities to small and marginal farmers. Jharkhand faces pressure to feed the 32 million human and 3.42 % of national livestock population with just 2.42 % land of the country. In this state livestock is rearing over 0.12 %of fodder area and 0.95 % of grazing land and contributing equal percentage of fodder and milk (0.9%) yield in national pool with 180 g/day/capita available milk for Jharkhand people against the 240 g/day/capita for national average (Anonymous, 2016) [3]. As feed and fodder contains about 55-60 per cent of total cost of milk production (Singh, K.A.2008) [4]; thus, good quality of green fodder having sufficient nutritive value is the demand of the day. In India, oat was introduced in the early
However, in some areas, it is grown for grain to be used as baby food, breakfast food and animal feed. It is grown in Uttar Pradesh, Madhya Pradesh, Haryana, Punjab, Himachal Pradesh, Rajasthan, Bihar, Gujarat, Andhra Pradesh and Tamil Nadu. There are some constraints that limit the production of oats in India. The main constraint is that the people still consider it as a minor cereal, so it is generally cultivated for fodder purpose in small areas as livestock feed. Since it is considered minor there is inadequate supply of nutrients to the crop, which results in low productivity. Adopting proper techniques of cultivation and nutrient management can lead in better grain and fodder productivity (Amareet Kujur and Thomas Abraham, 2017) [1]. Jharkhand meets hardly 50 per cent of the feed and fodder requirement for their livestock. The farmers face green fodder deficiency in winter when they have only paddy straw, dry stalks of summer cereal fodders or dry summer grasses. Thus, there is needed to grow green fodder during Rabi season from available limited irrigation resources.

Materials and method
A field experiment was conducted at Forage research field situated at College of Veterinary Science and Animal Husbandry of Birsa Agricultural University, Kanke, Ranchi during Rabi season in 2017-18. The soil was sandy loam in texture having sand (56.8%), silt (20.8%) and clay (15.2%) with bulk density 1.54 Mg m⁻³, good water retention (FC 21.5 % and PWP 11.36 %), good soil aggregation (GMD 0.677 mm) and water holding capacity (38.7%). The soil reaction was acidic in nature with low available N and P, medium in available K and just above critical limit for available S content in soil. The initial organic carbon (4.90 g kg⁻¹) with available nitrogen (212.0 kg ha⁻¹), available phosphorus (24.3 kg ha⁻¹) and available potassium (144.7 kg ha⁻¹). In terms of biological properties of soil the population of Azotobacter (3.2 x 10⁴ cell g⁻¹ soil), Actinomycetes (12 x 10⁶ cell g⁻¹ soil) and CO₂ evolution (107 mg kg⁻¹ soil day⁻¹) was present in soil before the experimentation. The experiment was conducted in Split-split plot design with four cropping system as main plot treatment (T₁- Sole oat, T₂-Sole Lathyrus, T₃- Oat + Lathyrus (3:2) and T₄- Oat + Lathyrus (3:3) and three integrated nutrient management as Sub-plot (F₁- 100% RDF (inorganic), F₂- 50% of N of RDF (inorganic) + 50% N through FYM and F₃-50% of N of RDF (inorganic) + 50% N through Vermicompost). The fodder oat cultivar- JHO-99-2 and lathyrus cultivar Mahateora was sown in second week of November. Nutrient requirement were met through urea, Single super Phosphate, Muriate of potash, FYM and Vermi-compost. Inoculation of Rhizobium @ 500 g ha⁻¹ in Lathyrus and Azotobacter @ 500 g ha⁻¹ in oat were carried through seed treatment. The collected data were subjected to statistical analysis in standard format of split plot design and presented below in tabular and graphical form.

Result and Discussion
Green as well as dry fodder yield were recorded by harvesting gross plot in each treatment and then converted into q ha⁻¹.

Fodder Oat yield
Harvesting of fodder oat was taken at 70 days after sowing which is presented table in 4.5. Result showed that intercropping system and integrated nutrient management has significantly affected the fodder yield of oat in terms of green forage yield (GFY).

Sole oat grown with 100% RDF (inorganic) produced more green fodder yield (368.34 q ha⁻¹) which was significantly higher over other treatment combinations of different intercropping system and integrated nutrient management (Table 1.). Among the inter cropped, oat+ lathyrus (3:2) grown at 100% RDF (inorganic) produced highest GFY (291.67 q ha⁻¹) which was at par with same grown at 50% N of RDF (inorganic) + 50% N of RDF (vermicompost). Oat grown as intercropped with lathyrus in 3:2 ratio at 50% N of RDF (inorganic) + 50% N of RDF (vermicompost) produced higher tillers per square meter (312), plant height (145.2), LAI (4.29) which ultimately converted into green fodder production of 364.34 q ha⁻¹. Amonge et al. (2012) and Raja (2013) also reported similar results. Maximum green fodder oat yield of 368.34 q ha⁻¹ was recorded under sole oat sown with 100% recommended dose of fertilizer through in organic sources which was at par with oat + lathyrus (3:2) grown at 50% N of RDF (inorganic) + 50% N of RDF (vermicompost).

Fodder Lathyrus yield
Harvesting of fodder lathyrus was also carried with oat at 70 days after sowing. Green fodder yield (GFY) of lathyrus were recorded and converted into q ha⁻¹ is presented at under mentioned table 1. Result showed that, intercropping system and integrated nutrient management significantly affect the GFY of lathyrus. Oat+ lathyrus (3:3) grown at 50% N of RDF (inorganic) + 50% N of RDF (vermicompost) produced higher yield (91.67 q ha⁻¹) than oat + lathyrus (3:2) at any nutrient management. Besides it, 50% N of RDF (inorganic) + 50% N of RDF (vermicompost) was significantly superior to 50% N of RDF (inorganic) + 50% N of RDF (FYM) and at par with 100% RDF as Inorganic under different cropping system. Besides it, the sole lathyrus grown at different nutrient management produced at par green fodder yield, however, it was higher at 137. 00 q ha⁻¹ at 100% RDF as inorganic. Sole lathyrus grown at 50% N of RDF (inorganic) + 50% N of RDF (vermicompost) produced longer vine length (109.67 cm), GFY (136.67 q ha⁻¹) at harvest. This might be due to plenty supply of N along with P and K, which increased the protoplasma constituents and accelerated the process of cell division and elongation (Babalad et al., 1993; Joon et al., 1993; Pisol et al., 1993 and Pradhan and Mishra, 1994) [6, 7, 10, 11].

Total green fodder yield
Total green fodder yield under sole oat at 100% RDF as Inorganic (368.34 q ha⁻¹) and oat + lathyrus (3:2) grown at 50% N of RDF (inorganic) + 50% N of RDF (vermicompost) (364.34 q ha⁻¹) were at par to each other. Sole oat at different nutrient management produced lower fodder yield which was nearly 182.6 per cent lower than the highest produced. Total green fodder yield under sole oat and oat+ lathyrus (3:2) cultivated with 100 per cent RDF from inorganic sources was at par with oat+ lathyrus (3:2) grown at 50% N of RDF (inorganic) + 50% N of RDF (vermicompost). Maximum green fodder yield under sole oat at 100% RDF (inorganic) was about 182.60% more than minimum under sole lathyrus grown at 50% N of RDF (inorganic) + 50% N of RDF (FYM), This is due to combined effect of growth and yield attributing characters of individual crop due to availability of nutrient and amount of sun light received. As intercropped lathyrus received less amount of radiation and faces competition for nourishment, while oat get better.

**Table 1:** Green fodder yield (q ha⁻¹) as influenced by integrated nutrient management in fodder Oat + *Lathyrus* intercropping system

<table>
<thead>
<tr>
<th>Intercropping system (A)</th>
<th>Integrated Nutrient Management (B)</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100 % RDF as Inorganic</td>
<td>50 % N of RDF (inorganic) + 50 % N of RDF (FYM),</td>
</tr>
<tr>
<td></td>
<td>Oat</td>
<td>Lathyrus</td>
</tr>
<tr>
<td>Sole Oat</td>
<td>368.34</td>
<td>319.00</td>
</tr>
<tr>
<td>Sole Lathyrus</td>
<td>137.00</td>
<td>130.34</td>
</tr>
<tr>
<td>Oat+Lathyrus (3:2)</td>
<td>201.67</td>
<td>277.00</td>
</tr>
<tr>
<td>Oat+Lathyrus (3:3)</td>
<td>153.34</td>
<td>281.34</td>
</tr>
<tr>
<td>Mean</td>
<td>292.11</td>
<td>262.78</td>
</tr>
</tbody>
</table>

## Conclusion

In general, the result of this experiment shows that the highest green fodder yield of sole fodder oat at 100 % RDF as inorganic was 368.34 q ha⁻¹, while sole *lathyrus* at 100 % RDF (inorganic) produced 137.33 q ha⁻¹ green fodder which was at par with sole *lathyrus* (136.67 qha⁻¹) at 50 % N of RDF (inorganic) + 50 % N of RDF (vermicompost). Total maximum green fodder yield under sole oat (368.34 qha⁻¹) at 100 % RDF (inorganic) and 363.34 qha⁻¹ at 50 % N of RDF (inorganic) + 50 % N of RDF (vermicompost) under oat+*lathyrus* (3:2) were at par with each other. On the basis of the findings of the experiment it may be concluded that, the fodder oat + *lathyrus* (3:2) grown at 50 % N of RDF + 50 % N of RDF (vermicompost) will be beneficial for maximum green fodder yield during *Rabi* season from available limited irrigation resources in Jharkhand.


## Reference


