RESPONSE OF MIXED CROPPING WITH DIFFERENT SEED RATES ON YIELD, QUALITY AND ECONOMICS OF FODDER PRODUCTION UNDER IRRIGATED CONDITION

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SUMMARY

Field study was carried out at Agricultural Research Station, SKRAU, Bikaner on sandy soil during rabi season of 2015-16 to 2017-18. Treatments comprises namely T1 - 100 % Seed rate Oats (100 kg/ha), T2 - 100 % Seed rate lucerne (20 kg/ha), T3 - T2 + Oats 10 kg/ha, T4 - T2 + Oats 20 kg/ha, T5 - T2 + Oats 30 kg/ha, T6 - T2 +40 Oats kg/ha, T7 - T2 + Sarson 0.625 kg/ha, T8 - T2 + Sarson 1.250 kg/ha, T9 - T2 + Sarson 1.880 kg/ha and T 10 - T2 + Sarson 2.500 kg/ha in randomized block design with three replications. lucerne + Oat seed mixed treatments (T5) gave higher GFY and DMY as compared to remaining treatments like lucerne + sarson seed mixed treatments and sole lucerne & oat crop. Further data indicated that lucerne + sarson mixed crop treatments recorded higher GFY (except T7), but the variation in GFY was statistically significant. The highest DMY (129.8 q/ha) was recorded in Lucerne + oat mixed with 30 kg/ha (T5). The highest CP % was noted in sole lucerne (T2) followed by lucerne + sarson mixed at 0.625 kg/ha (T5) and both these treatment found significantly superior over rest treatments. The maximum net return and B:C ratio found in sole oat (T2) was at par in lucerne + oat mixed @ 30 kg/ha (T5) and both treatments showed statistically superiority over rest treatments. However, oat sole crop gave four cuts and lasts fodder production up to mid April while lucerne + oat mixed treatment (T5) gave six cuts and lasts fodder production up to mid June.

Key words: Lucerne, oats, net returns, sarson, yield

Rajasthan is the largest state of India and covers nearly 342.65 lakh ha of total geographical area of the country. 62% area of hot arid land of India is located in western part of Rajasthan state of India and majority of the area is rainfed. It makes animal husbandry more important to give livelihood security to the people. There is large animal population in this region and fodder supply for the animals for green and dry fodder is important. The large livestock population shows importance of fodder in the state. Green fodder obtained from trees and shrubs can be fed to animals in green condition or after drying. Dry fodder of annual crops and legumes is major part for animal feeding but it should be supplemented by some green fodder in animal diet for balanced nutrition of animals. So, fodder security for this increasing livestock population will be ensured by promoting fodder crops and fodder and feed storage systems (Jha and Tiwari, 2018).

Lucerne, Berseem, oats, mustard etc are the main winter fodder crops which are grow in this region for green fodder as well as dry fodder production in irrigated condition. Lucerne is also known as rikja or alfalfa and considered as “queen of fodder crop”. Its native place is South-West Asia. Lucerne is a productive fodder which can support not only growth but also milk production it contains 18-22 per cent crude protein and 25-23% crude fibre according to the maturity. It is a hardy crop which belongs to leguminous family and can be survive in drought condition also. Oat is a highly esteemed fodder specifically for conservation in the form of hay throughout the world. Oat may be considered as maintenance quality fodder containing about 7-9% crude protein, can be increased up to 11% by nitrogen fertilizers in which case it may be considered as a productive fodder. The mustard leaves of young plants are used as green vegetables and green stem and leaves are a good source of green fodder for cattle. It’s also contains 6.39% crude protein.

Fodders are 5-14 times cheaper source of feed ingredients like digestible crude protein and total digestible nutrients than concentrates (Agrawal et al., 2008). Oats form an excellent combination, when fed
along with legume crops like berseem, lucerne (alfalfa) and senji (Indian clover) and other then cereals like sarson (Haq et al., 2018). Crop mixtures involving gobi sarson, intercrop two rows of oats as fodder crop higher productivity and monetary returns as compared to sole crop (PAU, 2019). Forage cereal-legumes intercropping systems result in improved production efficiency, complementary use of resources, weed control, better nutritional quality and higher economic returns (Iqbal et al., 2019).

**MATERIALS AND METHODS**

Field study was carried out at Agricultural Research Station, SKRAU, Bikaner during **rabi season** of 2015-16 to 2017-18. Treatments comprises namely T<sub>1</sub> - 100 % Seed rate Oats (100 kg/ha), T<sub>2</sub> - 100 % Seed rate lucerne (20 kg/ha), T<sub>3</sub> - T<sub>2</sub> + Oats 10 kg/ha, T<sub>4</sub> - T<sub>2</sub> + Oats 20 kg/ha, T<sub>5</sub> - T<sub>2</sub> + Oats 30 kg/ha, T<sub>6</sub> - T<sub>2</sub> + 40 Oats kg/ha, T<sub>7</sub> - T<sub>2</sub> + Sarson 0.625 kg/ha, T<sub>8</sub> - T<sub>2</sub> + Sarson 1.250 kg/ha, T<sub>9</sub> - T<sub>2</sub> + Sarson 1.880 kg/ha and T<sub>10</sub> - T<sub>2</sub> + Sarson 2.500 kg/ha in randomized block design with three replications. Experimental field soil was sandy loam in texture with medium in fertility status having OC 0.25%, and 111, 27.5, 220 kg/ha available NPK, respectively and alkaline in reaction (pH 8.28), and EC 0.09 ds/m of 2:1 soil water suspension. Sowing was done in November using recommended seed rate of lucerne, oat as sole and lucerne + mixed crop (oat/sarson) as per treatments. Fertilizers @ 20 kg N, 40 kg P<sub>2</sub>O<sub>5</sub>, 20 kg K<sub>2</sub>O and 12.5 kg ZnSO<sub>4</sub> as basal were drilled at sowing. Further 20 kg N in two equal splits at 30 DAS and after first cut for green fodder was broadcasted.

The average four cuts was harvested as green fodder first at 55 DAS and next cuts at 35 days interval, while in oats only three cuts harvested as green fodder. The plant samples were taken from randomly selected one running meter area of each plot at different growth stages to record fodder yield and yield components. Data regarding plant population, plant height, fresh weight, dry weight, green fodder yield and dry matter yield were recorded. Green fodder and dry fodder yields were determined by harvesting of each plot. The fodder yield was calculated after drying of sample in oven. For forage quality the samples were ground with a Wiley mill to pass a 1.0 mm screen and analyzed for quality components. Total N was determined using the Kjeldahl method and crude protein (CP) was calculated by multiplying the N content by 6.25. Statistical analysis was done for economics evaluation.

**RESULTS AND DISCUSSION**

**Yield performance**

The result based on the data presented in Table 1 reveal that lucerne + oat/sarson fodder production system at variable seed rate of mixed crop, lucerne + oat seed mixed treatments (T<sub>5</sub>) gave higher GFY and DMY as compared to remaining treatments like lucerne + sarson seed mixed treatments and sole lucerne & oat crop. Further data indicated that lucerne + sarson mixed crop treatments recorded higher GFY (except T<sub>7</sub>), but the variation in GFY was statistically non significant. The highest DMY(129.8 q/ha) was recorded in lucerne + oat mixed with 30 kg/ha (T<sub>5</sub>), while DMY reduced in Lucerne + sarson mixed at

<table>
<thead>
<tr>
<th>Treatment</th>
<th>GFY (q/ha)</th>
<th>DMY (q/ha)</th>
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<tbody>
<tr>
<td></td>
<td>2015-16</td>
<td>2016-17</td>
</tr>
<tr>
<td>T&lt;sub&gt;1&lt;/sub&gt; - Oat-100 kg/ha</td>
<td>662.9</td>
<td>470.80</td>
</tr>
<tr>
<td>T&lt;sub&gt;2&lt;/sub&gt; - Lucerne-20 kg/ha</td>
<td>553.0</td>
<td>307.00</td>
</tr>
<tr>
<td>T&lt;sub&gt;3&lt;/sub&gt; - (T&lt;sub&gt;2&lt;/sub&gt;+Oat 10 kg/ha)</td>
<td>633.3</td>
<td>553.50</td>
</tr>
<tr>
<td>T&lt;sub&gt;4&lt;/sub&gt; - (T&lt;sub&gt;2&lt;/sub&gt;+Oat 20 kg/ha)</td>
<td>637.5</td>
<td>551.53</td>
</tr>
<tr>
<td>T&lt;sub&gt;5&lt;/sub&gt; - (T&lt;sub&gt;2&lt;/sub&gt;+Oat 30 kg/ha)</td>
<td>656.0</td>
<td>605.97</td>
</tr>
<tr>
<td>T&lt;sub&gt;6&lt;/sub&gt; - (T&lt;sub&gt;2&lt;/sub&gt;+Oat 40 kg/ha)</td>
<td>642.7</td>
<td>547.53</td>
</tr>
<tr>
<td>T&lt;sub&gt;7&lt;/sub&gt; - (T&lt;sub&gt;2&lt;/sub&gt;+Sarson 0.625 kg/ha)</td>
<td>498.1</td>
<td>590.90</td>
</tr>
<tr>
<td>T&lt;sub&gt;8&lt;/sub&gt; - (T&lt;sub&gt;2&lt;/sub&gt;+Sarson 1.25 kg/ha)</td>
<td>566.5</td>
<td>544.80</td>
</tr>
<tr>
<td>T&lt;sub&gt;9&lt;/sub&gt; - (T&lt;sub&gt;2&lt;/sub&gt;+Sarson 1.88 kg/ha)</td>
<td>554.1</td>
<td>540.03</td>
</tr>
<tr>
<td>T&lt;sub&gt;10&lt;/sub&gt; - (T&lt;sub&gt;2&lt;/sub&gt;+Sarson 2.50 kg/ha)</td>
<td>568.4</td>
<td>555.83</td>
</tr>
<tr>
<td>S. Em±</td>
<td>13.20</td>
<td>27.11</td>
</tr>
<tr>
<td>C. D. (=0.05)</td>
<td>40.66</td>
<td>80.55</td>
</tr>
</tbody>
</table>
higher seed rate (T₉ & T₁₀) against the lowest DMY (99 kg/ha) recorded under sole oat (T₁) which was significantly lower in comparison to rest all treatments. A similar result was found in a research study where the dry matter yield of pea oat mixture was higher than the pea at all harvests (Kaiser et al., 2007).

**Crude Protein**

The results presented in Fig. 1 indicated that the highest CP % was noted in sole lucerne (T₂) followed by Lucerne + sarson mixed at 0.625 kg/ha (T₇) and both these treatment found significantly superior over rest treatments while the lowest CP % was noted in sole oat (13.5%). Similarly, the highest CP yield of 20.2 q/ha was computed under lucerne sole crop (T₂) against the minimum CP yield (13.5 q/ha) under oat sole crop Eskandari et al. (2009a) indicated that there was an increase in forage quality than cereal mono-crop and an increase in dry matter in comparison to legume monoculture (Rathor, 2016).

When compared with sole lucerne, CP yield decreased gradually by oat/sarson mixed at variable seed rates. Kumar et al. (2010) found higher crude protein yields with sole legumes than cereal legume mixtures.

**ECONOMICS**

The maximum net return and B : C ratio found in sole oat (T₁) was at par in lucerne + oat mixed @ 30 kg/ha (T₅) and both treatments showed statistically superiority over rest treatments. However, oat sole crop

![Fig. 1. Effect of lucerne+oat/sarson mixed production system on Crude Protein of fodder](image-url)
gave four cuts and lasts fodder production up to mid April while lucerne + oat mixed treatment (T5) gave six cuts and lasts fodder production up to mid June (Table 2).

CONCLUSION

After three year of field study, it may be concluded that combination of 20 kg/ha lucerne + 30 kg/ha oats seed was found overall best for getting higher yield for long time with good quality fodder.

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REFERENCES


