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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 T_1 - 100 % Seed rate Oats (100 kg/ha), T_2 - 100 % Seed rate lucerne (20 kg/ha), T_3 - T_2 + Oats 10 kg/ha, T_4 - T_2+ Oats 20 kg/ha, T_5 - T_2+ Oats 30 kg/ha T_6 - T_2+40 Oats kg/ha, T_7 - T_2 + Sarson 0.625 kg/ha, T_8 - T_2 + Sarson 1.250 kg/ha, T_9 - T_2+1.880 kg/ha and T_{10} - T_2 + Sarson 2.500 kg/ha in randomized block design with three replications. lucerne + Oat seed mixed treatments (T_5) 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_7), 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_5). The highest CP % was noted in sole lucerne (T_2) followed by lucerne + sarson mixed at 0.625 kg/ha (T_7) and both these treatment found significantly superior over rest treatments. The maximum net return and B:C ratio found in sole oat (T_1) was at par in lucerne + oat mixed @ 30 kg/ha (T_5) 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 (T_5) 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 rijka 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 gobhi 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_1 - 100 % Seed rate Oats (100 kg/ha), T_2 - 100 % Seed rate lucerne (20 kg/ha), T_3 - T_2 + Oats 10 kg/ha, T_4 - T_2 + Oats 20 kg/ha, T_5 -T_2 + Oats 30 kg/ha, T_6 - T_2 + 40 Oats kg/ha, T_7 - T_2 + Sarson 0.625 kg/ha, T_8 - T_2 + Sarson 1.250 kg/ha, T_9 - T_2 + 1.880 kg/ha and T_{10} - T_2 + 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_2O_5, 20 kg K_2O and 12.5 kg $ZnSO_4$ 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_5) 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_7), 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_5), while DMY reduced in Lucerne + sarson mixed at

TABLE 1
Effect of lucerne+oat/sarson mixed production system on fodder yield

Treatment	GFY (q/ha)				DMY (q/ha)			
	2015-16	2016-17	2017-18	Mean	2015-16	2016-17	2017-18	Mean
T_1–Oat-100 kg/ha	662.9	470.80	524.00	552.6	99.4	44.60	64.87	69.6
T_2–Lucerne-20 kg/ha	553.0	307.00	280.67	380.2	115.8	43.36	39.01	66.1
T_3–(T_2+Oat 10 kg/ha)	633.3	553.50	446.13	544.3	126.4	57.26	47.76	77.1
T_4–(T_2+Oat 20 kg/ha)	637.5	551.53	462.33	550.5	126.8	59.05	46.30	77.4
T_5–(T_2+Oat 30 kg/ha)	656.0	605.97	462.07	574.7	129.8	68.10	52.32	83.4
T_6–(T_2+Oat 40 kg/ha)	642.7	547.53	391.93	527.4	121.5	66.73	45.22	77.8
T_7–(T_2+Sarson 0.625 kg/ha)	498.1	590.90	402.07	497.0	115.4	60.77	65.24	80.5
T_8–(T_2+Sarson 1.25 kg/ha)	566.5	544.80	430.73	514.0	122.0	59.13	68.05	83.1
T_9–(T_2+Sarson 1.88 kg/ha)	554.1	540.03	399.17	497.8	109.2	58.80	53.56	73.9
T_{10}–(T_2+Sarson 2.50 kg/ha)	568.4	555.83	476.07	533.4	102.3	61.33	52.14	71.9
S. Em±	13.20	27.11	31.73	-	2.45	2.17	4.39	-
C. D. (=0.05)	40.66	80.55	94.28	-	7.56	6.43	13.04	-

TABLE 2
Effect of lucerne+oat/sarson mixed production system on cost of cultivation and economics of fodder production.

Treatment	Cost of Cultivation (Rs/ha)				Net return (Rs/ha)				B : C ratio			
	2015-16	2016-17	2017-18	Mean	2015-16	2016-17	2017-18	Mean	2015-16	2016-17	2017-18	Mean
T_1–Oat-100 kg/ha	23001	28000	21851	24284	76434	66160	82949	75181	3.32	2.36	3.80	3.16
T_2–Lucerne-20 kg/ha	24994	26000	21851	24282	57956	35400	34282	42546	2.32	1.36	1.57	1.75
T_3–(T_2+Oat 10 kg/ha)	25405	29000	22251	25552	69590	81700	66976	72755	2.74	2.82	3.01	2.86
T_4–(T_2+Oat 20 kg/ha)	25794	29499	22651	25981	69831	80807	69816	73485	2.71	2.74	3.08	2.84
T_5–(T_2+Oat 30 kg/ha)	26199	30001	23051	26417	72201	91193	69362	77585	2.76	3.04	3.01	2.94
T_6–(T_2+Oat 40 kg/ha)	26596	30499	23451	26849	69809	79007	54936	67917	2.62	2.59	2.34	2.52
T_7–(T_2+Sarson 0.625 kg/ha)	25050	28800	21893	25248	49665	89380	58520	65855	1.98	3.10	2.67	2.58
T_8–(T_2+Sarson 1.25 kg/ha)	25099	29253	21932	25428	59876	79707	64214	67932	2.39	2.75	2.93	2.69
T_9–(T_2+Sarson 1.88 kg/ha)	25155	29299	21973	25476	57960	78707	57860	64842	2.30	2.69	2.63	2.54
T_{10}–(T_2+Sarson 2.50 kg/ha)	25196	25566	22014	24259	60064	85600	73200	72955	2.38	2.90	3.33	2.87
S. Em±	-	-	-	-	1979	5078	11978	-	0.08	0.18	0.5	-
C. D. (P=0.05)	-	-	-	-	6098	15087	35586	-	0.24	0.53	1.6	

higher seed rate (T_9 & T_{10}) against the lowest DMY (99 kg/ha) recorded under sole oat (T_1) 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 (T_2) followed by Lucerne + sarson mixed at 0.625 kg/ha (T_7) 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 (T_2) 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 (T_1) was at par in lucerne + oat mixed @ 30 kg/ha (T_5) and both treatments showed statistically superiority over rest treatments. However, oat sole crop

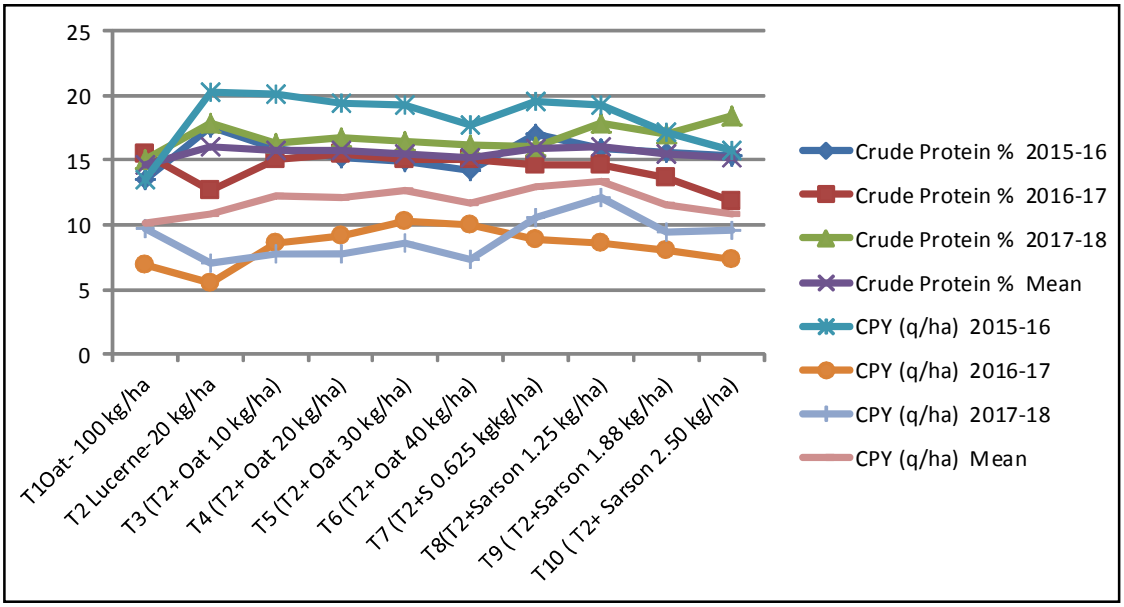

Fig. 1. Effect of lucerne+oat/sarson mixed production system on Crude Protein of fodder

gave four cuts and lasts fodder production up to mid April while lucerne + oat mixed treatment (T_5) 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

Agrawal, R. K., Sunil Kumar, S. B. Tripathi, R. K. Sharma and K. A. Singh. 2008 : Agro-economic analysis of fodder based cropping system. *Indian J. Fert.*, **4**(4) : 121-122 & 125-131.

Ansarul Haq, S., K. Joseph Korieng, T. A. Shiekh, F. A. Bahar, Khurshid A. Dar, Waseem Raja, Rayees A. Wani and N.S. Khuroo, 2018 : Yield and quality of winter cereal-legume fodder mixtures and their pure stand under temperate conditions of Kashmir valley. *Int. J. Curr. Microbiol. App. Sci.,* **7**(2) : 3626-3631.

Eskandari, H., A. Ghanbari, and A. Javanmard, 2009a : Intercropping of cereals and legumes for forage production. *Notulae Scientia Biologicae*, **1**(1) : pp 07.

Iqbal, M. A., A. Hamid, T. Ahmad, M. H. Siddiqui, I. Hussain, A. Sajid Ali, A. Ali, and Z. Zahoor Ahmad, 2019 : Forage sorghum-legumes intercropping : Effect on growth, yields, nutritional quality and economic returns. Bragantia, Campinas, V. 78, No. 1, p. 82-95.

Jha, S. K. and Nitish Tiwari, 2018 : Evaluation of intensive fodder cropping systems for round the year green fodder production in Chhattisgarh. *Forage Res.*, **44**(2) : 115-118.

Kaiser, A. G., B. S. Dear and S. G. Morris, 2007 : An evaluation of the yield and quality of oat– legume and ryegrass–legume mixtures and legume monocultures harvested at three stages of growth for silage. *Australian Journal of Experimental Agriculture*, **47**(1) : 25-38.

Kumar, B., U. S. Tiwana and M. L. Mehra, 2010 : Fodder yield and quality as influenced by different seed rates of oats, sarson and rye grass in mixture with berseem. *Range Mgmt. & Agroforestry*, Symposium Issue (A), 2010 : 9-10.

PAU, 2019. Package of Practices for Crops of Punjab (*kharif*). Punjab Agricultural University, Ludhiana (Punjab), India, **36**(2) : 24-25.

Rathor, B. M., 2016 : Intercropping leguminous crop plant with non-legumes. Life Science Informatics Publication, *RJLBPCS*, **2**(4) : 183-201.