Impact of balanced fertilization and legume mixture on fodder oat (*Avena sativa L.*)

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Abstract- A field experiment was conducted to study the effect of balanced fertilization and legume mixture on fodder oat productivity during *rabi* season at instructional farm, Rajasthan College of Agriculture, Udaipur (Rajasthan). Legume mixture oat + berseem (2:1 row ratio) and oat + lucerne (2:1 row ratio) significantly improved number of tillers/m^2, green fodder, dry fodder yield and protein yield over sole oat. Similarly, application of 120 kg N+ 60 kg P_2O_5 + 30 kg K_2O/ ha significantly improved the highest number of taillers/m^2, green fodder, dry fodder yields and protein yield over nitrogen application to the magnitude of 11.93 and 11.36; 31.91, 30.83 and 31.39, 8.88, 11.57 and 10.19 and 10.94 and 13.05 percent at first and second cutting, respectively.

Index Terms- Fodder oat, balanced fertilization, legume mixture

I. INTRODUCTION

In most of the developing countries of the world, livestock is an integral part of the agricultural economy. Crop production system is closely linked with animal husbandry as a complementary enterprise. Crops are of prime importance for economic feeding of animal on one hand, and on the other hand, the livestock through the supply of organic manures and draft power helps in balancing crop growth. The importance is more emphasized in India, as it owns the largest livestock population in the world and accounts nearly 16 per cent of the world's cattle population. The contribution of livestock sector to agriculture GDP accounts for 25 per cent of agricultural output and now India has become the largest producer of milk in the world (Kadrieval, 2002). In India, Rajasthan state has 54 million livestock population and the animal heads exceed human heads, which posses the problem of feed-fodder security for the state. Nearly 8 per cent of the milk and 40 per cent of wool production in the country is from Rajasthan state (FAO 1998). It has been experienced that even in the best agricultural years fodder supply through all the sources is short of aggregate fodder demand in the state.

In order to make animal husbandry sector more viable and productive sector there is a great need to maintain balanced feed and fodder supply in the state. The major dependence on agricultural by-product to feed the animal is detrimental to the growth of both livestock and crop sector in the state. Once the fodder supply is streamlined with more nutritious feed and fodder by stall-feeding, more productive milch herd can be sustained which in turn would accelerate the growth of milk production in the state. At present time, requirements of fodder are not fulfilled. Majority of the animals are reared under sub-optimal conditions because of shrinkage in grazing land, poor management of wasteland and grazing pressure per unite land. Availability of nutritious feed and fodder through proper scientific methods, are essential for the improvement of the vast livestock resource. Therefore, there is a need to boost the production of green and dry fodder yield. Among the fodder crops, oat is important winter forages. It is highly nutritive forage, which is rich in soluble carbohydrates. Being more energizing, it forms a good feed for horses and draught as well as milch animals (Kumar and Rai, 1976). Puri *et al*. (2010) observed higher fodder yield of the ryegrass + oat/sarson over pure crop of ryegrass in the first cutting. Tiwana and Singh (2012) reported that cropping system of oat + sarson gave higher fodder yield when harvested at 65 days after sowing (DAS) as compare to 55 DAS. Kumar *et al*. (2010) reported 29.9 percent crude protein content in berseem + 1.88 kg sarson/ha as compared to 27.9 percent in pure berseem. The balanced nutrient supply ensures efficient use of all nutrients. One nutrient may affect the efficiency of other nutrients. Since, there is paucity of information of aforesaid aspect a field experiment entitled "Impact of balanced fertilization and legume mixture to fodder oat (*avena sativa* L.)" was planned.

II. MATERIALS AND METHODS

The field experiment ware conducted during *rabi* at Instructional farm, Department of agronomy, Rajasthan College of Agriculture, Udaipur. The soil of experimental fields was clay loam in texture, alkaline in reaction (pH 7.9 and 8.1), medium in available N, P and higher in potassium 287.00 and 283.00, 22.61 and 22.75 and 390.00 and 397.00 kg/ha and organic carbon 0.71 and 0.81%. The treatments consisting of seven legume mixtures *viz*., L_0= sole oat; L_1 = oat + berseem (2:1 row ratio); L_2 = oat + berseem (3:1 row ratio); L_3 = oat + berseem (4:1 row ratio); L_4 = oat + lucerne (2:1 row ratio); L_5 = oat + lucerne (3:1row ratio); and L_6 = oat + lucerne (4:1 row ratio) and three balanced fertilization *viz* .,N (120 kg/ha); N+P (120 kg N+60 kg P_2O_5/ha) and N + P + K (120 kg N+ 60 kg P_2O_5 + 30 kg K_2O/ha) were tested in a split plot design having legume mixtures in main plots and balanced fertilization in sub plots and replicated thrice. Crop was sown on Nov. 22nd and 20th in first and second year, respectively. Crops were fertilized with nitrogen through urea, P_2O_5 and K_2O through DAP and MOP as per treatment. One third dose of nitrogen and full dose of phosphorus and potassium

were applied in basal application at sowing time and rest 1/3rd nitrogen at first irrigation and treatment 1/3rd dose after first cutting. First and second cutting of crop were harvested on January 21 and March 21 during first year and January 21 and March 21 during second year of experimentation, respectively.

III. RESULTS AND DISCUSSION

Legume mixture

A critical examination of data (Table and Figure 1, 2 and 3) reveals that legume mixture had significant effect on number of tillers/m^2, green fodder, dry fodder yield, protein content and protein yields over oat at first and second cutting in pooled analysis. The pooled data for the two years show that oat : berseem (2:1) recorded significantly higher number of tillers/m^2, green fodder, dry fodder yield, protein content and protein yields amounting to increases of 16.71 and 20.35 and 22.76 and 22.99 and 22.87; 17.87, 21.00 and 19.38; 110.58 and 12.30; 29.95 and 35.60 percent, respectively over sole oat sown. Legume mixture oat + berseem (2:1) was closely followed by oat + lucerne (2:1) in pooled analysis and significantly improved the above said parameters over sole oat, respectively. The observed improvement in various characters might be owing to beneficial effect of legumes on cereal as legume fixes nitrogen in the soil through the process of biological nitrogen fixation, which is utilized by the oat and its role in tillering is well established. These findings was corroborating with the findings of Choubey and Prasad (2001).

Balanced Fertilization

It is evident from the data presented in Table and Figure 1, 2 and 3 reveals that balanced fertilization had significant effect on number of tillers/m^2, green fodder, dry fodder yields, protein content and its production at both the cuttings in pooled analysis. Application of 100% NPK (120 kg N + 60 kg P_2O_5 + kg K_2O/ha) significantly recorded the highest number of tillers/m^2, green fodder yield, dry fodder yield and protein yield over N alone and N+P both application in pooled analysis. The corresponding increases were to the magnitude of 11.90 and 11.36; 31.91, 30.83 and 31.39; 8.88, 11.57 and 10.19 and 10.94 and 13.05 percent in case of number of tillers/m^2, green fodder yield, dry fodder and protein yield over nitrogen application. Application of F_2 significantly imported the above mentioned traits over N alone during both the years and in pooled analysis. The findings of the present investigation are in corroboration with the findings of Roy and Pradhan (1992) and Jayanthi *et al.* (2002).

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Table 1. Effect of legume mixtures and balanced fertilization on number of tillers per meter square of fodder oat (Pooled)

Treatments	Number of tillers per meter square	
	First cutting	Second cutting
Legume mixtures :		
L_0	625.8	615.0
L_1	730.3	740.2
L_2	717.2	722.1
L_3	698.4	683.3
L_4	728.1	728.3
L_5	707.9	703.3
L_6	687.3	671.1
CD(P=0.05)	37.4	40.1
Balanced fertilization:		
F_1	660.6	657.8
F_2	697.9	694.0
F_3	739.4	732.5
CD(P=0.05)	22.4	23.2

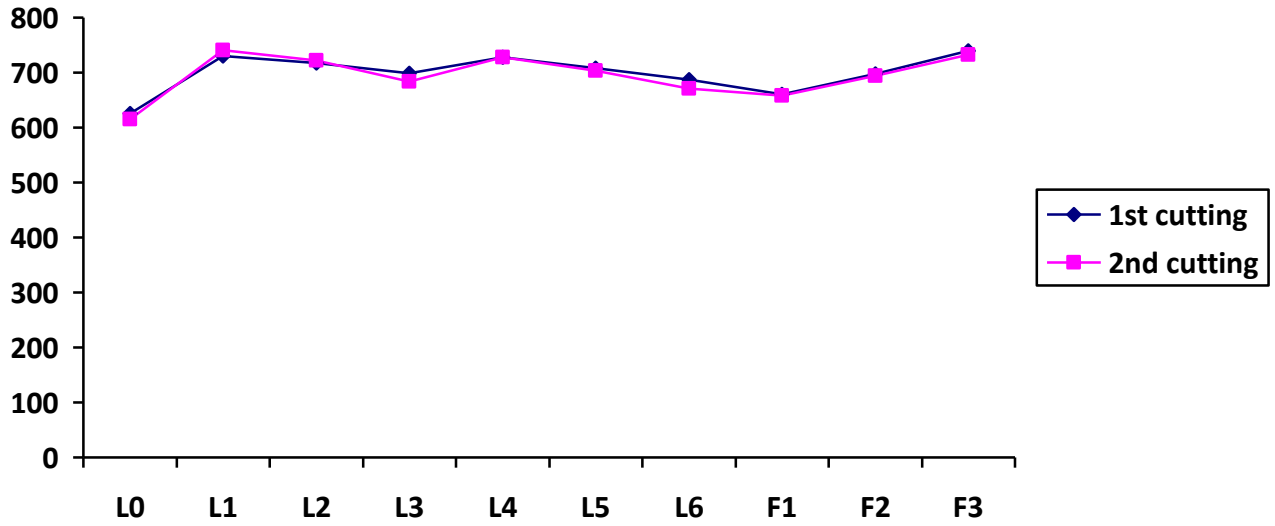

Figure 1. Effect of legume mixtures and balanced fertilization on number of tillers per meter square of fodder oat (Pooled).

Table 2. Effect of legume mixtures and balanced fertilization on green fodder yield and dry matter yield (q/ha) (Pooled)

Treatments	Green Fodder Yield			Dry matter yield		
	First cutting	Second cutting	Total	First cutting	Second cutting	Total
Legume mixtures :						
L_0	216.14	203.07	419.21	39.29	37.19	76.48
L_1	265.33	249.75	515.08	46.31	45.00	91.30
L_2	253.50	237.08	490.58	42.93	41.65	84.61
L_3	241.55	223.95	465.50	42.37	40.43	82.80
L_4	261.21	245.39	506.60	45.41	43.81	89.22
L_5	251.22	235.17	486.39	43.15	41.71	84.86
L_6	238.17	222.97	461.14	40.92	39.58	80.50
CD(P=0.05)	13.521	12.696	25.180	2.053	1.942	3.890
Balanced fertilization:						
F_1	215.90	202.16	418.05	41.10	39.06	80.16
F_2	239.50	226.52	466.03	42.87	41.39	84.26
F_3	284.79	264.48	549.27	44.75	43.58	88.33
CD(P=0.05)	7.752	7.296	14.450	1.136	1.194	2.260

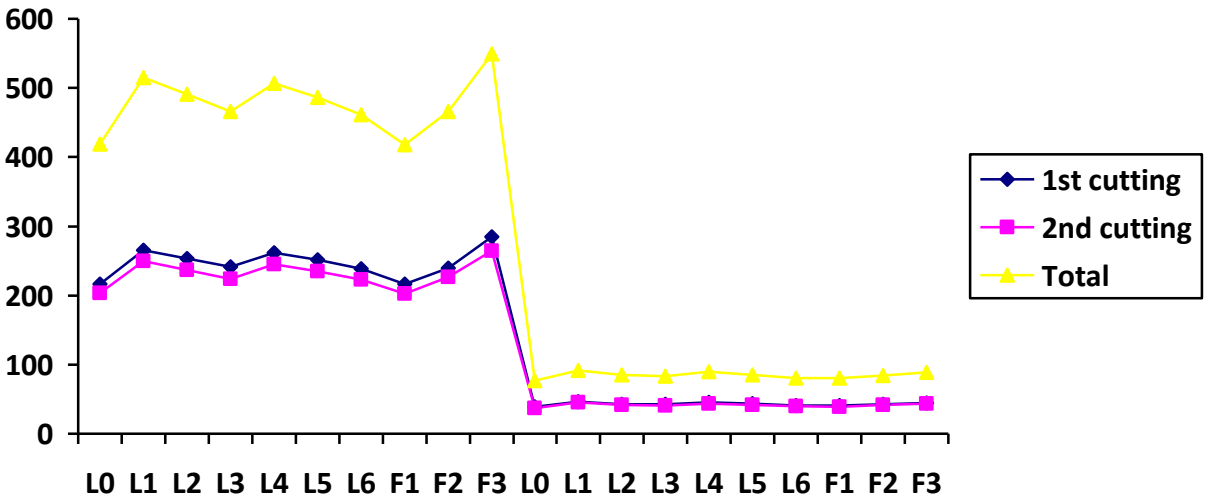

Figure 2. Effect of legume mixtures and balanced fertilization on green fodder yield and dry matter yield (q/ha) (Pooled).

Table 3. Effect of legume mixtures and balanced fertilization on content and production of crude protein of fodder (pooled)

Treatments	Crude protein content (%)		Crude protein production(Kgha^{-1})	
	First cutting	Second cutting	First cutting	Second cutting
Legume mixtures :				
L0	10.11	10.08	398.91	376.41
L1	11.18	11.32	518.39	510.42
L2	10.99	11.00	472.51	459.62
L3	10.94	10.95	464.51	443.61
L4	11.09	11.19	504.41	490.90
L5	10.99	10.96	475.07	457.92
L6	10.93	10.92	447.92	433.02
CD(P=0.05)	0.328	0.334	33.339	31.286
Balanced fertilization:				
F1	10.78	10.84	444.10	425.08
F2	10.92	10.93	469.69	453.75
F3	10.97	10.98	492.69	480.55
CD(P=0.05)	0.151	0.161	18.002	18.896

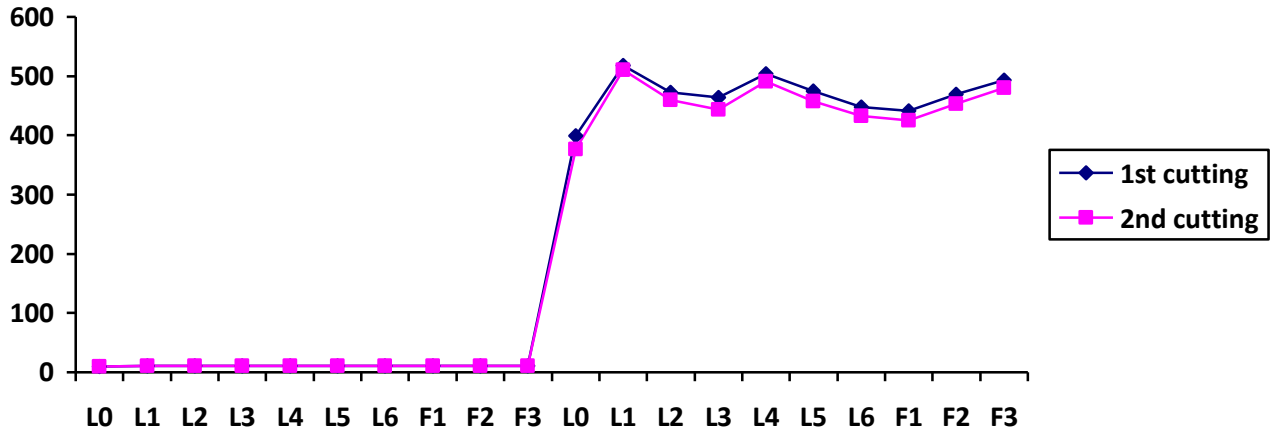

Figure 3. Effect of legume mixtures and balanced fertilization on content and production of crude protein of fodder (pooled)