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QUALITY CHARACTERISTICS AND ECONOMICS OF DIFFERENT BERSEEM (*TRIFOLIUM ALEXANDRINUM* L.) CULTIVARS AS INFLUENCED BY BIOFERTILIZERS AND CUTTING MANAGEMENT

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SUMMARY

An investigation entitled, "Quality characteristics and economics of berseem (*Trifolium alexandrinum* L.) as influenced by biofertilizers and cutting management" was conducted at the Agricultural Research Farm of J.V. College, Baraut (Baghpat). The experiment was laid in a factorial randomized block design with four types of cuttings (C1= cutting 1.5 above ground, C2= cutting 3.5 above ground, C3= cutting 5.5 above ground and C4= cutting 7.5 above ground), three levels of biofertilizers viz. (B1= Control, B1= *Rizobium* and B3= *Rizobium* + PSB) and two varieties of berseem viz. V1= Mescavi (Pusa) and V2= Bhart Kaveri with four replications. The results revealed that among different types of cuttings, quality characteristics of berseem such as crude protein percentage and crude fact percentage were recorded highest with treatment C3 i.e. when cutting was at 5.5 above the ground. In case of different levels of biofertilizers, quality characteristics of berseem were observed to be highest with combined application of *Rizobium* + PSB. Moreover, variety Mescavi was found to be superior in quality aspect and gave the higher net returns as compared to local variety.

Key words : Berseem, Quality, Economics, Biofertilizers and Cutting management

Livestock rearing, an important subsidiary occupation of the farmers plays a vital role in Indian agriculture. With increase in livestock population and their improvement, the grazing and feeding requirements also increased many folds. However, diminution of grasslands and agricultural by- products, consequent to the development of dwarf high yielding varieties, growing pressure on land for food are the factors coming in the way of meeting the enhanced livestock forage needs (Venkateshwarlu *et al.*, 1997). Against this background, specialized forage cultivation assumes greater significance. Green fodder, nutritionally balanced and palatable constitute basic ration for milch cattle and farm animals for higher milk production and work efficiency respectively, apart from reducing feed and over-head costs. Among the forage crops, berseem is a leguminous fodder known for high seasonal forage yield and quality. It is an annual leguminous crop, well adapted to the semi-arid conditions of the Northern India with good nitrogen fixing ability. Berseem fodder is highly palatable due to its succulence and nutritious with 20% crude protein and 62% total digestible nutrients. Therefore, it is very suitable green fodder for all classes of livestock. Besides being a good green fodder, the importance of berseem in increased soil fertility is universally recognized and this beneficial effect is usually attributed the nitrogen added to the soil by the legume in a crop rotation. By keeping in view the importance of the berseem crop it is essential to rise per hectare of the crop but nutrient availability is one the most important factors during plant development. While with the adoption of suitable varieties, proper seed inoculation of the berseem crop, adoption of improved agronomic practices and most importantly judicious use of biofertilzers and manures along with fertilizers is a critical component to crop production in sustainable farming systems (Canbolat *et al.*, 2006) and can raise the production per hectare of the berseem green fodder to a considerable extent. So, in this regard, adoption of improved berseem varieties is one of the most important methods of increasing green fodder yield of berseem per hectare. Generally the berseem crop grown in India is diploid. Lack of systematic and scientific manuring is the most important factor affecting the low yield per hectare of green fodder of berseem. Hence, the present investigation was undertaken with the objective to the study the quality characteristics and economics of different varieties of berseem (*Trifolium alexandrinum*

L.) as influenced by biofertilizers and cutting management.

MATERIALS AND METHODS

The present investigation was conducted at the Agricultural Research Farm of J.V. College Baraut (Baghpat). The experiment was laid out in a factorial randomized block design with four types of cuttings (C_1= cutting 1.5 above ground, C_2= cutting 3.5 above ground, C_3= cutting 5.5 above ground and C_4= cutting 7.5 above ground), three levels of biofertilizers viz. (B_1= Control, B_1= *Rhizobium* and B_3= *Rhizobium* + PSB) and two varieties of berseem viz. V_1= Mescavi (Pusa) and V_2= Bharrt KAVERI (20 cal) with four replications. Before sowing of Berseem, soil samples from 0-15 cm depth were taken from the experimental field and analyzed for physical and chemical properties to find out the fertility status and soil class (Table 1). The preparation of the experimental field was done by following local package and practices. After preparing the field, it was divided into 4 replications with 24-plots is each replication.

Crude protein percent and production : The nitrogen content of the oven dried samples of fodder was determined as per Wright, 1939. The crude protein percentage was worked out by multiplying nitrogen percentage with 6.25 constant. The production of crude protein was calculated as under:

Crude protein yield (kg/ha)=Crude protein percent x dry matter (kg/ha)/100

Crude fibre percent and production : The crude fibre content was estimated by the method described by Wright, 1939. The production of the gradient was calculated as under:

Crude fibre yield (kg/ha)=Crude fibre percent x dry matter (kg ha^{-1})/100

Economics : For economic analysis, cost of cultivation, gross return, net profit and benefit cost ratio of all the treatments calculated at the prevailing rates. Gross income taken as total income derived from sale price of berseem fodder. The net return calculated by deducting the cost of cultivation from gross income for different treatments.

Statistical analysis : The statistical analysis of each biometrical observation was done by the method suggested by Fisher and Yates (1957) for the factorial RBD. The significance of treatment effects was tested with the help of "F" test and the significance of difference between two means to treatments were tested by critical difference (CD).

TABLE 1
Physico-chemical properties of the experimental soil

Soil components	Values (%)	Method of Analysis
A. Mechanical analysis		
(i) Sand (%)	51.6	Hydrometer method
(ii) Silt (%)	22.4	
(iii) Clay (%)	26.0	
***The soil of the experimental field is sandy clay loam**		
B. Chemical analysis		
(i) Organic carbon (%)	0.56	Walkley and Black, 1934
(ii) Total N (%)	0.053	Lindner, 1944
(iii) Available N (kg/ha)	235.76	Subbiah and Asija, 1956
(iv) Available P (kg/ha)	16.58	Olsen *et al.*, 1954
(v) Available K (kg/ha)	246.40	Flame photometer
(vi) pH	7.60	Jackson, 1967
(vii) EC dsm-2	2.11	Richards, 1954

RESULTS

Quality characteristics of green fodder : A perusal of data (Table 2) on quality characteristics of green fodder indicated different types of cuttings, biofertilizers levels and varieties significantly affected the quality characteristics of berseem. The C_3 cutting i.e cutting 5.5 cm above the ground obtained significantly highest crude protein (20.13 %), crude fat (1.45 %) and crude fibre (21.75 %) followed by C_2 (19.52, 1.38 and 21.23 %) cutting over C_4 (18.56, 1.41 and 21.19 %). Whereas, C_1 cutting of berseem was observed to have significantly lowest crude protein (18.21 %), crude fat (1.33 %) and crude fibre (20.81 %), respectively. Moreover, the various bio-fertilizers also significantly affected the quality characteristics of berseem and crude protein (21.30 %), crude fat (1.48 %) and crude fibre (22.02 %) were observed to be the highest with the application of *Rhizobium* + PSB over alone *Rhizobium* application (19.28, 1.41 and 21.44 %) and over control plot (16.74, 1.30 and 20.32 %), respectively. The quality characteristics of berseem were found towards downfall in control plot (without *Rhizobium* and PSB). Moreover, among the different varieties of berseem, var. Mescavi gave the highest crude protein content (20.64 %), crude fat (1.41 %) and crude fibre (21.83 %) over local variety (17.58, 1.37 and 20.69 %), respectively.

TABLE 2
Effect of cuttings, bio-fertilizers and varieties of berseem on crude protein, crude fat and crude fibre in green fodder

Treatments	Crude protein in green fodder (%)	Crude fat in green fodder (%)	Crude fibre in green fodder (%)
A. Cuttings			
C_1	18.21	1.33	20.81
C_2	19.52	1.38	21.23
C_3	20.13	1.45	21.75
C_4	18.56	1.41	21.19
S. Ed	0.51	0.022	0.12
C. D. (P=0.05)	1.02	0.044	0.24
B. Bio-fertilizers			
B_0	16.74	1.30	20.32
B_1	19.28	1.41	21.44
B_2	21.30	1.48	22.02
S. Ed	0.44	0.019	0.11
C. D. (P=0.05)	0.88	0.038	0.21
C. Varieties			
V_1	20.64	1.41	21.83
V_2	17.58	1.37	20.69
S. Ed)	0.36	0.016	0.09
C. D. (P=0.05)	0.72	0.031	0.17

Economics : Over all performance of berseem green fodder yield was illustrated in terms of total green fodder yield, coast of cultivation, gross and net income. These results have been presented in table 3 and also showed in Fig. 1.

1. **Green fodder yield q/ha :** The data presented for total green fodder yield (C_1+C_2+C_3+C_4) revealed that the highest yield q/ha obtained by *Rhizobium* + PSB and variety MASCAVI over rest treatment and without treated and local variety (B_0 V_1) recorded lowest green fodder yield q/ha.
2. **Cost of cultivation (Ps/ha) :** The cost of cultivation Rs. 15800 recorded with B_2 V_1. It is increased due the cost of *Rhizobium* + PSB.
3. **Gross income Ps/ha :** The gross income Rs. 44030 was recorded with B_2 V_1 treatment which was highest over rest treatment combinations.
4. **Net income Ps/ha :** The net income Rs. 28240 was recorded by B_2 V_1 treatment which was higher over rest treatment combinations.

TABLE 3
Effect of bio fertilizers and varieties of berseem on total green fodder yield q/ha, cost of cultivation gross and net income Rs/ ha

Treatments	Green fodder yield q/ha	Cost of cultivation	Gross income	Net income Rs/ha
B_0 V_1	579	15190	40530	25340
B_0 V_2	550	15520	38500	22980
B_1 V_1	607	15440	42490	27050
B_1 V_2	581	15480	40670	25190
B_2 V_1	329	15790	44030	28240
B_2 V_2	602	15800	42140	26340

Discussion

Proper nutrient management in crop production not only improves and stabilizes the yield, but also will improve the environmental health. Application of integrated fertilizing treatments not only optimized and moderated sole chemical fertilizer application (consequently reducing the environmental pollutions), but it also enhanced the features of the forage quality in terms of higher macro and micro nutrients concentration in plant tissues. The results obtained with respect to quality characteristics and economics of different berseem (*Trifolium alexandrinum* L.) cultivars are discussed here under the following heads:

Effect of cuttings : The various types of cuttings significantly affected the crude protein content, crude fat percent and crude fibre percent (table 2) and economics of green fodder yield q/ha (table 3) were observed to be significantly higher C_3 cutting over other types of cuttings i.e. C_1, C_2 and C_4. These results were to be expected since the forage dry matter

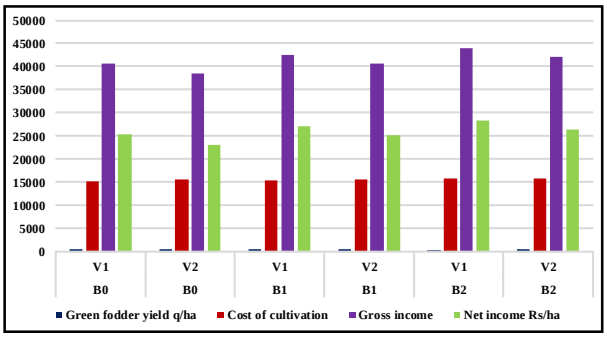

Fig. 1. Effect of bio fertilizers and varieties of berseem on total green fodder yield q/ha, cost of cultivation gross and net income Rs/ha

increased from the C_1 type of cutting to the C_3 cut and thereafter attain a steady growth rate and hence peak value for various growth and quality characters was observed to be in C_3 type of cutting. Similar results were found by other workers Hathout *et al.* (1997) and El Kramany *et al.* (2012). Moreover, these declines are influenced by weather parameters like temperature and photoperiod. The increase in maximum and minimum temperature with the delay in cutting might be the reason for decreased duration of vegetative and reproductive phases and pollinator movement and low quality of crop. Similar findings were reported by Puri *et al.* (2008) in Maize crop grown for fodder purpose.

Effect of bio-fertilizers : Quality characteristics such as crude protein content, crude fat percent and crude fibre percent (table 2) and economics of green fodder yield q/ha (table 3) were significantly increased with the application of *Rhizobium* + PSB. The maximum crude protein content, crude fat percent and crude fibre percent was recorded in *Rhizobium* + PSB treatment. The significant increment in crude protein at integrated biological fertilizer application of *Rhizobium* + PSB treatment could probably be explained by more nitrogen and phosphorous availability for roots in rhizosphere environment (Gholamhosiani *et al.*, 2012). Chemical and biofertilizers combinations could decrease the chemical fertilizer utilization without any considerable reduction in forage quality (Turk *et al.*, 2009; Ebrahim-Ghoshchi *et al.*, 2012). Co-inoculation of alfalfa seed with different biological fertilizers in a phosphorus deficient soil resulted in increased forage dry matter, more N_2 fixation and better phosphorus content, compared to inoculation with single bacteria (Stancheva *et al.*, 2008). Singh *et al.* (2010) reported a significant improvement in the crude protein content of corn and wheat following inoculation with PGPR. Basanthi *et al.* (2012b) also reported that application of farm yard manure+*Rhizobium*+phosphate solubilizing bacteria+*Azospirillium* resulted in enhanced yield attributes and thereby enhancing the quality characteristics. The similar findings were also reported by Patel *et al.*, 2010 and Sonali *et al.*, 2012.

Effect of varieties : The different cultivars of berseem, significantly affected the quality characteristics such as crude protein content, crude fat percent and crude fibre percent (table 2) and economics of green fodder yield q/ha (table 3) and MASCAVI Pusa genotypes recorded the better quality characteristics such as crude protein content, crude fat percent and crude fibre percent and economics of green fodder yield q/ha over local variety of berseem. This may be attributed to the reason that Pusa variety may be well adapted to that environment of evaluation and due to its better genotype have found to be the best performer among the tested varieties. These results are in agreement with those reported by Lannucci (2004) and Santis *et al.* (2004).

Effect on economics : The cost of cultivation increased with the *Rhizobium* + PSB because the additional cost of *Rhizobium* + PSB increased the cost of cultivation. The gross income also increases with the application of *Rhizobium* + PSB. It is attributed to reason that application of biofertilizers appreciably increased the yield of green fodder of berseem and therby giving the higher net returns.

CONCLUSION

It was observed that improving the chemical, biological and especially physical properties, with the conjunctive use of biofertilizers and recommended dose of chemical fertilizers causes the appropriate nutritional conditions and increases the nutrients uptake and leads to better growth and development of berseem. Application of integrated fertilizing treatments not only optimized and moderated sole chemical fertilizer application but it also enhanced the features of the forage quality in terms of higher macro and micro nutrients concentration in plant tissues. Therefore, from the results of the study it can be concluded that integrated fertilizing treatments may be accounted more efficient in berseem cultivation in irrigated ecosystems.

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