A Study on Sustainable Modules for Year-Round Green Fodder Production under Irrigated Conditions

Arvind Singh Negi

Asst. Professor, School of Agriculture, Graphic Era Hill University, Dehradun Uttarakhand India

Abstract

Zonal Agricultural Research Station, Vishweswaraiah Canal Farm, Mandya, conducted "Studies on sustainable modules for year-round green fodder production under irrigated conditions" throughout the kharif, rabi, and summer seasons of 2018–19 and 2019–20. The experiment had three replicates and was set up in a randomized whole block design with fifteen fodder cropping system components. Green fodder yield (1636 q ha-1 year-1), dry fodder yield (321 q ha-1 year-1), carbon sequestration (24.87 Mg ha-1) and net returns (Rs. 2,14,232 ha-1 year-1) were all significantly higher for the BN hybrid + Lucerne (2:8) perennial system than they were for the BN hybrid + Cowpea (2:8) perennial system (1552 q ha-1 year-1, 308 q ha-1 year-1, 24.35.

***Keywords**: Sustainable Modules, Round Green Fodder, Production, Irrigated conditions.*

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1. Introduction

Mixed farming and livestock rising are vital to rural livelihoods in India, illustrating the interconnected nature of agriculture and animal husbandry in the country. Despite the fact that the agricultural sector's share of India's GDP is shrinking, 52% of the country's labour force is employed in either the agricultural or livestock industries. India's agricultural sector relies heavily on the country's abundant livestock resources, which generate 25.6% of the agricultural GDP and 4.1% of the country's overall GDP. The livestock industry provides much of the fuel for farms and supplies most people with their annual dose of animal protein. As a result, India has historically been home to several important breeds of draught, milch, and dual-purpose cattle. The current cattle industry is intricate and tied to the country's history, culture, and economy. Additionally, there has been a rapid change in agriculture in terms of cropping system, crop diversification, intensification of agriculture, availability of water resources, increasing use of mechanical power, transformation from subsistence to market oriented farming, changing food habits, etc., to achieve food security for ever-increasing population of the country, all of which have substantial impact on existing animal husbandry practises. [1-3]

The 20th Livestock Census was carried out in 2019, revealing a total livestock population of 535.78 million in the nation, up 4.6% from the 2012 Livestock Census. While the percentage of the country's agricultural area that can be used to grow green fodder crops has remained stable at roughly 5% over the last several decades. As a consequence, the livestock industry has never been able to fully tap into its potential for output since the availability of feed and fodder resources have consistently fallen short of the normative demand. Currently, most farmers are able to satisfy their fodder needs via a combination of agricultural leftovers, grazing (on pastures, woodlands, and fallow areas), and planted forage crops. Animals are often fed the low-quality grasses, bushes, and weeds that naturally grow on agricultural grounds, despite the fact that fodder production is not a prevalent practice in rural sections of the nation. As a result, they are putting more of an emphasis on seasonal fodder supplies, despite the fact that this shift increases milk price volatility and decreases consistency in fodder availability year-round. [4-5]

Green forages fed only to dairy cows are substantially more cost-effective than concentrates. Feeding animals a mixed diet of concentrates and green forages accounts for over 65% of the entire cost of milk production in cows. The cost of feeding milch animals can be greatly reduced by providing them with ample quantities of green fodder rather than expensive concentrates and feeds. This is because the cost of feeding milch animals rises to 80% when they are primarily fed concentrates, but drops to 40% when they are fed forages. [6-7]

2. Literature review

Hadi, M. R. and Fathi, M. (2020) Coimbatore 3 (CO-3), Coimbatore 4 (CO-4), Thumburmuzhy, Australian Napier, and wild grass (Sony grass) were the five fodder kinds analysed. Their physical parameters, proximate composition, and fibre fractions were estimated and compared. Varieties of fodder varied in the amount of dry matter they contained, from 14.85 percent to 26.47 percent. On a dry matter basis, the range for crude protein was 10.49-16.07%, for crude fibre it was 32.01-35.99%, for ether extract it was 1.5-3.11%, for total ash it was 11.2-14.81%, for acid-insoluble ash it was 3.6-5.60%, and for nitrogen-free extract it was 34.02-39.57%. There was a wide range in the percentages of NDF, ADF, and hemicellulose, all of which were found to be between 60.84 and 77.10 percent.[8]

Amin, M. El-M., H. (2019) In the cattle business, increasing production of forage has been a contentious topic. Green fodder is crucial to the success of the livestock business as a whole because it provides essential nutrients for animals. There is a shortage of 827.2, 426.1, and 85.8 million tonnes of green fodder, dry fodder, and concentrates in India, respectively (11.24%, 23.40%, and 29.00%, respectively; Roy et al., 2019). Karnataka is now experiencing a shortage of green fodder (30 million tonnes), dry fodder (24.5 million tonnes), and concentrate (74.5 million tonnes) compared to the state's current demands. [9]

Bama, K. S. (2018) Forage planting methods provide a workable answer to the fodder problem by optimizing resource use, increasing annual output per acre, and financially rewarding farmers. Animals acquire a well-rounded diet thanks to the combination of legume and grain fodder crops. Efficient cropping techniques, such as intercropping and intensive fodder production systems, may sequester carbon dioxide in the soil, giving farmers a chance to counteract their own and industrial emissions. Incorporating legumes into crop rotations is another strategy for fixing atmospheric nitrogen and boosting soil fertility.[10]

Banjara, T. R. and Bohra, J. S. (2017) Cowpea-based intercropping systems outperformed those based on sorghum, pearl millet, or maize in terms of plant height, dry matter accumulation, and leaf to stem ratio of primary crops. Green fodder yield (647.13 q ha-1) and dry fodder yield (172.86 q ha-1) were both highest for the sweet sorghum + cowpea system, followed by the sweet sorghum + ricebean system (632.86 and 162.01 q ha-1). Under the Tarai agro climatic environment in Uttarakhand, the yields of the pearl millet + pillipesara intercropping system were lower (467.13 and 87.59 q ha-1, respectively).[11]

Shori A. and Prajapat K. (2016) Maintaining a constant supply of nutrient-rich feed for cattle requires year-round production of green fodder, even in years when forage is scarce. Sustainable modules in irrigated regions might allow for year-round production of green feed. In order to maximize production while minimizing adverse impacts on the environment, these modules integrate efficient water management with careful crop selection and cultivation techniques. Sustainable modules for green fodder production under irrigated conditions throughout the year are the focus of this guide. The program's objective is to educate farmers in efficient methods of raising forage yields, bettering forage quality, and reducing water use. Adopting these modules may help farmers increase the stability and profitability of their livestock businesses and expand sustainable agriculture practices. [12]

3. Methodology

Field trials were conducted at the Zonal Agricultural Research Station (ZARS), Vishweshwaraiah Canal (VC) Farm, Mandya, University of Agricultural Sciences, Bangalore throughout the kharif, rabi, and summer seasons of 2018–19 and 2019–20. The intricacies of the investigation's procedure, including sources consulted, techniques used, and steps taken.

3.1 Location of the experimental site

The University of Agricultural Sciences in Bangalore's Zonal Agricultural Research Station at the Vishweshwaraiah Canal Farm in Mandya was where these experiments took place. It sits at an altitude of 695 meters above mean sea level in the southern dry zone (ACZ-VI) of Karnataka, which extends from 12 degrees 45 to 13 degrees 57 north latitude and 76 degrees 45 to 78 degrees 24 east longitude.

3.2 Experimental details

In order to identify which modules of a sustainable cropping system are required for a year-round supply of high-quality fodder, experiments were conducted throughout the kharif, rabi, and summer seasons of the 2018-2019 and 2019-2020 agricultural years.

3.3 Treatments and experimental design

The experiment was carried out using a Randomized Complete Block Design, and it was repeated three times (Table 3.1). There were fifteen different treatment options.

Table 3.1: Specifications on the various treatments that were part of the experiment

SL. No.	Treatments
T1	Plant Food Corn and Cowpea (3:1) Seed Mix: (3:1) Fodder Oat and Cowpea Pearl millet with cowpeas at a 3:1 ratio
T2	Animal Feeding Sorghum and Cowpea (3:1) Feeding Maize with Cowpea (3:1) Pearl millet with cowpeas in a 3:1 ratio.
T3	A perennial BN hybrid and Cowpea (2:8) system
T4	Perennial BN hybrid + lucern (2:8)
T5	Planting method based on BN hybrids and Desmanthus (2:8)
T6	Perennial BN hybrid + Sesbania (2:8)
T7	Fodder corn, fodder corn, fodder corn
T8	Sorghum for Animal Feed, Sorghum for Animal Feed, Fodder Sorghum
T9	Animal feed cowpeas; animal feed cowpeas; animal feed cowpeas
T10	The Perennial System of Desmanthus
T11	Perennial Sesbania Arrangement
T12	BN Perennial Hybrid System
T13	Perennial Lucerne Roots
T14	FodderOats-FodderOats-FodderOats
T15	FodderPearlmillet-FodderPearlmillet-FodderPearlmillet

3.4 Statistical Analysis

In order to conduct a statistical analysis on the gathered experimental data, Fisher's technique of analysis of variance was used, as detailed by Gomez and Gomez (1984). Tabulated findings for each character's analysis were organized by treatment, and those results were provided in the results chapter. The 'F' test was used to analyze the differences between everything, and the threshold of significance was set at 5%. In the event that the findings were significant, a critical difference (CD) was computed using a threshold of probability of 5% in order to assess the difference in mean between the two treatment groups.

4. Results

Research on "Studies on sustainable modules for year round green fodder production under irrigated condition" was conducted at the Zonal Agricultural Research Station, Vishweshwaraiah Canal Farm, Mandya, University of Agricultural Sciences, Bangalore during the kharif, rabi, and summer seasons of 2018–19 and 2019–20.

Various components of the fodder cropping method have substantial effects on the harvest dry matter accumulation. Table 4.1 summarizes the data.

The BN hybrid + lucerne (2:8) perennial system accumulated the most dry matter (3199 g m2), although the BN hybrid + sesbania (2:8) and BN hybrid + cowpea (2:8) perennial systems accumulated almost the same amount of dry matter (3123 and 3070 g m2), respectively. Dry matter accumulation in single cropping systems of cowpea, desmanthus, oats, and pearl millet, however, was shown to be much lower (1548, 1562, 1663, and 1777 g m2). The pattern remained consistent throughout both time periods. Under perennial intercropping systems, plants were able to make better use of water, nutrients, and sunlight, leading to increased growth parameters like plant height and the number of tillers or branches, which could have led to increased dry matter accumulation due to better partitioning of photosynthates.

Table 4.1: Modules of a year-round fodder cropping system's dry matter accumulation and dry matter content

Treatments	Dry matter accumulation			Dry matter (0/0)		
	2018-19	2019-20	Mean	2018-19	2019-20	Mean
T_1:Animal Feed Corn and Cowpea (3:1) 3.1 Oats and Cowpeas for Animal Feed Rice + Cowpea (3:I)	2221	2309	2265	20.59	20.58	20.59
T_2:Sorghum with Cowpeas (3:1) as Animal Feed Forage Pearl millet + cowpea (3:1) maize + cowpea (3:1)	2371	2501	2436	21.17	21.23	21.20
T_3:Perennial system based on BxN hybrids and Cowpea (2:8)	3033	3107	3070	19.87	19.76	19.81
T_4':Annual BxN hybrid plant + perennial Lucerne (2:8)	3 165	3233	3199	19.64	19.52	19.58
T_5: BxN hybrid + Desmanthus (2:8) perennial	2505	2588	2546	19.44	19.52	19.48

system						
T_6': BxN hybrid + Sesbania (2:8) perennial system	3001	3245	3 123	21.72	21.73	21.72
T_7': Fodder Maize Fodder Maize - Fodder Main	2113	2169	2141	20.58	20.47	20.52
T_8: Fodder Sorghum Fodder Sorghum - Fodder Sorghum	2052	2101	2077	23.01	22.96	22.99
T_9: Fodder Cowpea Fodder Cowpea Fodder Cowpea	1516	1581	1548	19.90	20.06	19.98
T_{10}: Desmanthus perennial system	1511	1614	1562	19.66	19.75	19.70
T_{11}: Sesbania perennial system	2048	2179	2114	22.10	22.09	22.10
T_{12}: BxN hybrid perennial system	2438	2501	2469	19.60	19.64	19.62
T_{13}: Lucerne perennial system	1866	1935	1900	19.98	20.07	20.02
T_{14}: Fodder Oats - Fodder Oats - Fodder Oats	1617	1710	1663	20.24	20.16	20.20
T_{15}: Fodder Pearlmillet Fodder Pearlmillet Fodder Pearlmillet	1711	1842	1777	20.80	20.97	20.89
F-test	*	*	*	*	*	*
S.Em.+,-	122	136	88	0.70	0.71	0.70
CD	356	396	257	2.03	2.07	2.04

Various parts of the fodder cropping system have a considerable impact on the total amount of dry matter accumulated by harvest time. In table 4.1, we can see the results.

There was a substantial effect of several modules of the fodder cropping system on the green fodder yield of fodder crops as measured at harvest. Information on how various modules of a fodder cropping system affect dry matter production is provided in table 4.2.

Table 4.2: Comparison of the green fodder and dry matter yields of several modules of a year-round fodder cropping system

Treatments	Green fodder yield (q ha -1 year''			Dry matter yield (q he year''		
	2018-19	2019-20	Mean	2018-19	2019-20	Mean
T_1:Animal Feed Corn and Cowpea (3:1) 3.1 Oats and Cowpeas for Animal Feed Rice +	1080	1125	1103	223	232	227
T_2:Sorghum with Cowpeas (3:1) as Animal Feed Forage Pearl millet + cowpea (3:1) maize	1125	1182	1154	238	250	244
T_3:Perennial system based on BxN hybrids and Cowpea (2:8)	1530	1575	1552	304	312	308
T_4':Annual BxN hybrid plant + perennial	1614	1659	1636	317	324	321
T_5: BxN hybrid + Desmanthus (2:8)	1292	1329	1310	251	259	255
T_6': BxN hybrid + Sesbania (2:8) perennial	1384	1497	1440	301	325	313
T_7': Fodder Maize Fodder Maize - Fodder	1030	1063	1047	212	217	215
T_8: Fodder Sorghum Fodder Sorghum -	895	918	906	206	211	208
T_9: Fodder Cowpea Fodder Cowpea Fodder	765	792	778	152	159	155
T_{10}: Desmanthus perennial system	772	821	796	152	162	157
T_{11}: Sesbania perennial system	930	990	960	205	219	212
T_{12}: BxN hybrid perennial system	1247	1277	1262	244	251	248
T_{13}: Lucerne perennial system	937	968	952	187	194	191
T_{14}: Fodder Oats - Fodder Oats - Fodder	803	851	827	162	172	167
T_{15}: Fodder Pearlmillet Fodder Pearlmillet	825	882	854	172	185	178
F-test	*	*	*	*	*	*
S.Em.+,-	59	55	63	12	14	13
CD	173	160	184	36	39	38

When compared to the other cropping system modules (BN hybrid + sesbania (2:8) and BN hybrid + cowpea (2:8) perennial systems), the BN hybrid + lucerne (2:8) perennial system recorded a higher dry matter yield (321 q ha1 year'). Dry matter yields for year-round monocultures of cowpea, desmanthus, oat, pearlmillet, and lucerne were much lower (155, 157, 167, 178, and 191 q ha1 year', respectively). Dry matter yields of 48.29, 48.91, 52.02, 55.45, and 59.50 percent are achieved in the BN hybrid + lucerne (2:8) perennial system. A pattern evolved during the course of the two years of study. Perennial fodder intercropping system modules may have higher dry matter production while having a lower dry matter content due to the larger green fodder output of the component crops.

Table 4.3 displays data showing how various modules of fodder cropping systems affected fodder nitrogen concentration.

Compared to cereal fodder crops, the nitrogen content of the cropping system modules that contained legume fodder crops was much greater. While the nitrogen content of solo lucerne and sole cowpea systems (3.34 and 3.28%, respectively) were similar, the nitrogen content of sole perennial systems incorporating sesbania (3.57%) was much greater on a pooled basis. The nitrogen concentration of year-round cereal fodder crops such sorghum, pearl millet, maize, BN hybrid, and oats was much lower (1.30, 1.36, 1.58, 1.59, and 1.66%, respectively). The pattern remained consistent over both time periods. More nitrogen was able to be used by the plant because of the legume fodder crops' particular symbiosis with the Rhizobia in the soil, increasing the plant's nitrogen content.

Table 4.3 provides information on how various modules of a fodder cropping system affect the amount of nitrogen taken up by the crops.

Nitrogen intake was much greater when legume fodder crops were included as part of the perennial cropping system modules as opposed to solitary cereal fodder crops cultivated year-round. On a pooled basis, the nitrogen intake of the BN hybrid + Sesbania (2:8) perennial system was 989 kg ha', which was comparable to the nitrogen uptake of the BXN hybrid + Lucerne (2:8) and the BN hybrid + Cowpea (2:8) perennial systems (963 and 896 kg ha1 year, respectively). In contrast, annual monocultures of feed pearlmillet, sorghum, and oats absorbed much less nitrogen (243, 270, and 277 kg ha1 year', respectively). Both years showed the same general pattern. To improve fertilizer availability in the soil to component crops, using legumes as an intercrop with cereals may aid in the extraction of subterranean nutrients to the surface of the soil by dehiscence of leaves and twigs.

Table 4.3: Components of a year-round fodder cropping system and their effects on nitrogen content and absorption

Treatments	Nitrogen content (%)			Nitrogen uptake (kg ha- year')		
	2018-19	2019-20	Mean	2018-19	2019-20	Mean
T_1:Animal Feed Corn and Cowpea (3:1) 3.1 Oats and Cowpeas for Animal Feed Rice +	1.92	1.98	1.95	426	456	441
T_2:Sorghum with Cowpeas (3:1) as Animal Feed Forage Pearl millet + cowpea (3:1) maize	1.85	1.85	1.86	439	464	452
T_3:Perennial system based on BxN hybrids and Cowpea (2:8)	2.88	2.95	2.91	874	918	896
T_4':Annual BxN hybrid plant + perennial	2.97	3.04	3.01	941	986	963

T5: BxN hybrid + Desmanthus (2:8)	2.59	2.63	2.61	651	684	667
T6': BxN hybrid + Sesbania (2:8) perennial	3.14	3.18	3.16	943	1035	989
T7': Fodder Maize Fodder Maize - Fodder	1.58	1.59	1.58	336	346	341
T8: Fodder Sorghum Fodder Sorghum -	1.30	1.30	1.30	266	274	270
T9: Fodder Cowpea Fodder Cowpea Fodder	3.28	3.28	3.28	500	520	510
T10: Desmanthus perennial system	2.94	2.98	2.96	447	483	465
T11: Sesbania perennial system	3.55	3.59	3.57	730	785	758
T12: BxN hybrid perennial system	1.58	1.59	1.59	388	398	392
T13: Lucerne perennial system	3.28	3.38	3.34	615	658	637
T14: Fodder Oats - Fodder Oats - Fodder	1.67	1.65	1.66	271	283	277
T15: Fodder Pearlmillet Fodder Pearlmillet Fodder Pearlmillet	1.35	1.38	1.36	232	254	243
F-test	*	*	*	*	*	*
S.Em.+,-	0.10	0.11	0.10	28	41.25	33
CD @ 5%	0 28	0.32	0.30	83	120	96

Table 4.4 provides information on how various modules of fodder cropping systems affected the overall carbohydrate content of fodder crops.

Total carbohydrate content was highest in the cereal fodder crops, whereas total protein content was highest in the legume fodder crops. When compared to single fodder sorghum, the total carbohydrate content of pearlmillet grown under a solitary cropping system was much greater (80.75%). Sesbania is the only perennial cropping system that has a low total carbohydrate content (62.93 percent). Throughout both years of analysis, a consistent pattern emerged. Cereal fodder crops have a larger total carbohydrate content than legume fodder crops because to their lower crude protein and ash concentrations.

Table 4.4 shows the considerable effect that various modules of fodder cropping systems have on the overall carbohydrate yield of fodder crops.

Compared to the BN hybrid + Cowpea (2:8) and BN hybrid + Sesbania (2:8) perennial systems (208 and 203 q ha" year), the BN hybrid Lucerne (2:8) system showed considerably greater total carbohydrate production (215 q ha' year') on a pooled basis.

Table 4.4: Modules of a year-round fodder cropping system with their resulting total carbohydrate content (CHO) and yield

Treatments	Total CHO (%)			Total CHO yield (q		
	2018-19	2019-20	Mean	2018-19	2019-20	Mean
T_1:Animal Feed Corn and Cowpea (3:1) 3.1 Oats and Cowpeas for Animal Feed Rice +	75.81	75.21	75.51	170	174	173
T_2:Sorghum with Cowpeas (3:1) as Animal Feed Forage Pearl millet + cowpea (3:1) maize	76.17	75.91	76.04	180	190	185
T_3:Perennial system based on BxN hybrids and Cowpea (2:8)	68.00	67.13	67.57	207	209	208
T_4':Annual BxN hybrid plant + perennial	67.48	66.69	67.09	214	216	215
T_5: BxN hybrid + Desmanthus (2:8)	70.93	70.20	70.57	179	182	181
T_6': BxN hybrid + Sesbania (2:8) perennial	65.54	65.08	65.31	197	209	203
T_7': Fodder Maize Fodder Maize - Fodder	77.23	77.24	77.23	164	168	166
T_8: Fodder Sorghum Fodder Sorghum -	80.60	80.50	80.55	166	170	168
T_9: Fodder Cowpea Fodder Cowpea Fodder	66.51	66.48	66.50	102	106	104
T_{10}: Desmanthus perennial system	69.99	69.02	69.50	106	112	109
T_{11}: Sesbania perennial system	62.93	62.93	62.93	129	138	133
T_{12}: BxN hybrid perennial system	76.86	76.70	76.78	188	193	190
T_{13}: Lucerne perennial system	65.76	65.61	65.69	123	127	125
T_{14}: Fodder Oats - Fodder Oats - Fodder	78.12	78.19	78.16	127	I34	130
T_{15}: Fodder Pearlmillet Fodder Pearlmillet	80.84	80.65	80.75	139	149	144
F-test	•	*	*		*	•
S.Em.+,-	2.56	2.66	2.68	9	8	8
CD @ 5%	7.44	7.74	7.79	25	23	22

Table 4.5 displays data showing that switching between modules of a fodder cropping system had no effect on the organic matter content of the fodder crops.

Organic matter content was highest in the pearlmillet-only cropping system (91.88 percent), lowest in the BN hybrid + Cowpea (2:8) perennial cropping system (88.79 percent), and this pattern held true throughout both research years. There is an inverse relationship between the fodder's organic matter and overall mineral concentration. Therefore, the increased organic matter content of fodder pearlmillet may be attributed to the reduced mineral content associated with the mono cropping scheme.

Table 4.5 displays the results of an analysis of the effects of several modules of a fodder cropping system on the relative feed value of fodder.

When compared to modules consisting of solo desmanthus, sole BN hybrid + Lucerne (2:8), and sole BN hybrid + Desmanthus (2:8), the relative feed value reported by the solitary perennial cropping system of lucerne was substantially greater (132.17%) on a pooled basis. However, modules of cropping systems that only produced BN hybrid and fodder maize had a lower relative feed value (81.11 and 83.56%, respectively). Throughout both years of analysis, a consistent pattern emerged. Higher relative feed value was achieved by the inclusion of legumes in cropping systems due to increased crude protein and decreased fiber fractions. The positive association between relative feed value and crude protein content (r2 = 0.74) and the substantial negative correlation between relative feed value and neutral detergent fibre (r2 = -0.96) support these findings.

Table 4.5: Comparison of the organic matter content and feed value of several modules of a year-round fodder cropping system

Treatments	Organic matter		%)	Relative feed value(%)		
	2018-19	2019-20	Mean	2018-19	2019-20	Mean
T_1: Fodder Maize + Cowpea (3: I) Fodder Oat + Cowpea (3. 1) Pearlmillet+ Cowpea	90.54	90.50	90.52	101.88	102.00	101.94
T_2: Fodder Sorghum + Cowpea (3: I) FodderMaize + Cowpea (3. 1) Pearlmillet+	90.64	90.55	90.59	98.50	98.18	98.34
T_3: BxN hybrid + Cowpea (2:8) perennial	88.97	88.60	88.79	115.22	115.42	115.32
T_4': BxN hybrid + Lucerne (2:8) perennial	89.22	89.06	89.14	126.11	125.42	125.77
T_5: BxN hybrid + Desmanthus (2:8)	90.04	89.83	89.94	123.26	121.72	122.49
T_6': BxN hybrid + Sesbania (2:8)	88.85	88.80	88.83	110.97	111.13	111.05
T_7': Fodder Maize Fodder Maize - Fodder	89.72	89.93	89.82	83.32	83.81	83.56
T_8: Fodder Sorghum Fodder Sorghum -	91.73	91.76	91.75	85.54	86.30	85.92
T_9: Fodder Cowpea Fodder Cowpea	89.67	89.74	89.71	117.84	118.83	118.34
T_{10}: Desmanthus perennial system	91.16	90.75	90.96	128.49	129.12	128.81
T_{11}: Sesbania perennial system	88.88	89.17	89.02	111.36	111.81	111.58
T_{12}: BxN hybrid perennial system	89.60	89.59	89.59	80.92	81.30	81.11
T_{13}: Lucerne perennial system	89.43	89.59	89.51	131.87	132.48	132.17
T_{14}: Fodder Oats - Fodder Oats - Fodder	91.59	91.53	91.56	99.35	100.43	99.89
T_{15}: Fodder Pearlmillet Fodder	91.87	91.89	91.88	88.56	90.27	89.41
F-test	NS	NS	NS	•	•	•
S.Em.+,-	2.77	2.75	2.96	4.14	4.58	4.25
CD @ 5%	-	-	-	12.06	13.35	12.37

5. Conclusion

In order to meet the existing feed needs of the nation's livestock population, it is crucial that suitable modules of the cereal-legume cropping system be adopted. Annual and perennial grain and legume fodder crops will yield different amounts and qualities of green fodder. More biomass is produced, and higher-quality fodder is harvested, when cereals and legumes are grown in an intercropping system. Intercropping grains and legumes for fodder is controversial due to disagreements over whether or not it helps maintain a constant supply of high-quality green fodder throughout the year. The Zonal Agricultural Research Station at Vishweshwaraiah Canal Farm in Mandya on the campus of the University of Agricultural Sciences in Bangalore conducted an agronomic field study titled "Studies on sustainable modules for year round green fodder production under irrigated condition" during the kharif, rabi, and summer seasons of 2018–19 and 2019–20.

6. References

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