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Effect of Organic and Inorganic Fertilizers on the Quantitative and Qualitative Parameters of Rice (*Oriza sativa* L.)

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Abstract

Rice is the most important staple cereals in human nutrition and consumed by 75% of the global population. Rice plant needs supply of essential nutrients for its optimal growth. Rice production has been increased tremendously in India after green revolution combined with insensitive irrigation and use of inorganic fertilizers and pesticides. However, the effect of using inorganic fertilizers has resulted in contamination of ground water and decreased the productivity of soil, which in turn affects the rice production in long term. Use of organic manure may help to regain the soil health but they are insufficient to provide the essential nutrients to achieve optimal growth. So, use of organic manures combine with inorganic fertilizers are followed to obtain optimum yields. This study aimed to test the effect of the different organic fertilizer and combinations of organic and inorganic fertilizers on the qualitative and quantitative parameters of two cultivars of rice as DRR Dhan 39 and RP.BIO.226. The experiment was conducted on the farm located at Fasalwadi village, Sangareddy district, Telangana during *kharif* season in randomized complete block design with three replications. The treatment included two controls and 10 combinations of four organic fertilizers as farmyard manure, vermicompost, Panchagavya, Jeevamrutha and inorganic fertilizers as combination of 60:75:75 levels of N, P and K. Grain and straw samples were collected and physical parameters were measured at harvest stage. The results indicated that the variety DRR Dhan 39 gave the statistically significant ($P<0.0001$) higher grain yield of 8713 kg/ha and straw yield of 9483kg/ha with 50% organic fertilizers of Vermicompost, Jeevamrutha 5% and Panchagavya 3% and 50% inorganic fertilizer of NPK. On the other hand, the variety of RP.BIO.226 gave the highest grain yield of 6390 kg/ha with Vermicompost, Jeevamrutha 5% and Panchagvya 3% (8 t/ha, foliar spray and 500 litres/ha) and highest straw yield of 7430 kg/ha with T10 treatment (50% organic fertilizers of Vermicompost, Jeevamrutha 5% and Panchagavya 3% and 50% inorganic fertilizer of NPK). Both varieties of rice poorly responded to inorganic fertilizers with lower grain and straw yield. Statistically significant differences were observed in both varieties of grain crude protein (CP%), straw acid detergent fiber (ADF%), crude fiber (CF%) and acid detergent lignin (ADL%) with different fertilizers.

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Introduction

Rice is one of the most important staple cereal foods in human nutrition and major food grain for more than a third of the world's population[6]. In world, 90% rice is produced and consumed in Asian countries. India and China accounts for half of the total area under rice cultivation. Indian agriculture has advanced over the past decades with green revolution adopting technological achievements, which includes the use of high yielding verities, improved irrigation systems, fertilizers and new farming systems.

Rice is an excellent source of carbohydrates containing approximately 87 % in grain. It contains 7 to 8 % of protein, which has higher digestibility, biological value and more nutritious, possesses lower crude fibre and lower fat (1 to 2%).Nearly twenty percent of the world's dietary energy is provided by rice alone, which is higher than either wheat or maize[1].

The most important and essential plant nutrient is nitrogen (N) and will increase the crop yield positively[19]. N is required for all non-legume crops on all soil types. Nitrogen is supplied by indigenous sources such as soil minerals, soil organic matter, rice straw, manure, and water through rain or irrigation. In which crop residues are not returning to land nowadays due to intensive use as animal feed and fuel. Soil organic matter can only be replenished in the short term by the application of organic matter such as manures[7]. However, organic manures contain relatively low nutrient content and thus unlikely to meet the requirement of high-yielding rice cultivars when used alone.

To achieve the higher yield of rice, inorganic fertilizers were used with little or no addition of organic manure. Even though the inorganic fertilizers were resulted in higher crop yield, over reliance on them associated with declined soil properties and degraded soils and in turn decreased yield in subsequent period[10]. In the western world the present farming system totally depends on chemical fertilizers, growth regulators, pesticides for enhancing crop productivity. Several ill effects in human health and environmental hazards were documented due to the use of chemical fertilizer[14]. Keeping these aspects in consideration, there is need for mid-way approach between organic and inorganic fertilizer use for agriculture production. Therefore, to make the soil well supplied with all the plant nutrients in the readily available form and to maintain good soil health, it is necessary to use organic manures in conjunction with inorganic fertilizers to obtain optimum yields[17].With a blend of safe modern technologies combined with traditional organic agriculture not in orthodox version has the potential to be accepted for higher yield.

Organic methods of agriculture production increasingly popular to reflect consumer demands. Application of organic manures give significant effect on development of crop plants and growth[24,26]. In organic agriculture, Panchagavya, an organic manure prepared from cow by products of milk, urine, dung, ghee and curd improves crop production[20]. Panchagavya is also used as a foliar spray for seed treatment as well as soil application along with irrigation[12]. Another important organic manure is farmyard manure, which was reported equal grain yield compared to nitrogen application through fertilizers[22]. Several studies recommended that sustainability could be achieved in intensive cropping systems through integration of organic and inorganic sources of nutrient application[8].

There are several studies recorded the benefits of organic and inorganic fertilizer combination for soil health in various crops. Application of organic manure in combination with chemical fertilizer has been reported to increase absorption of N, P and K in sugarcane leaf tissue in the plant and ratoon crop, compared to chemical fertilizer alone[4]. The organic and inorganic fertilizer has helped to sustain soil fertility and crop productivity in mint and mustard cropping sequence with the use of farm yard manure (FYM), NPK and Sesbania green manuring[5]. Based on the above consideration for use of organic and inorganic fertilizer combination for the higher crop yield, this study was undertaken to determine the influence of different combinations of organic and inorganic fertilizers on quantitative and qualitative parameters of two rice cultivars.

Materials and Methods

Experimental Site

A field experiment was conducted on the farm located in Fasalwadi village, Sangareddy district, Telangana during *kharif* season under rain fed conditions. The soil of study area is black and reddish brown in color,

clay loam in texture having 0.22% organic matter, 0.66 ppm available P and 89.3 ppm available K and pH of 8.18 at a depth of 0 - 30 cm indicating that the soil was alkaline in nature.

Experimental Design and Treatments

Treatments consisted of two cultivars of rice as DRR Dhan 39 and RP.BIO.226 and 12 combinations of organic and inorganic fertilizers including two controls were evaluated in randomized complete block design with three replications. The detail of the treatments and their application are given in table 1. The distances maintained between two replications and two plots were 2 and 0.5 m, respectively. The crop was sown at the spacing of 20 cm x 15 cm. The seed of rice cultivers were collected from Indian Institute of Rice research, Rajendranagar, Hyderabad.

Table1: Description of treatments

S. No.	Treatment	Details of treatment application
1	Control 1	Farm Yard Manure (FYM) 20 t/ha
2	Control 2	NPK 60:75:75 kg/ha
3	T1	Vermicompost 8 t/ha
4	T2	Panchagavya 3% as foliar spray
5	T3	Panchagavya 5% as foliar spray
6	T4	Jeevamrutha 5% 500 liters/ha
7	T5	Jeevamrutha 10% 500 liters/ha
8	T6	Vermicompost+ Panchagavya 3% 8 t/ha and foliar spray
9	T7	Vermicom.post+ Jeevamrutha 5%,8 t/ha and 500 liters/ha
10	T8	Vermicompost+ Panchagavya 3%+ Jeevamrutha5%,8 t/ha, foliar spray and 500 liters/ha
11	T9	NPK 25%+ Panchagavya3%+ Jeevamrutha 5%, 25% of NPK with 60:75: 75 kg/ha, foliar spray and 500 liters/ha
12	T10	NPK 50%+Vermicompost+ Panchagavya 3%+ Jeevamrutha 5%, 50% NPK with 60:75:75 kg/ha, 8 t/ha,foliar spray and 500 liters/ha

Organic fertilizers used in this experiment were farm yard manure, vermicompost, Panchagavya and Jeevamrutha. Inorganic fertilizer of N, P and K were used in combination of 60:75:75. Nitrogen was supplied in the form of ammonium sulphate, phosphorus as single super phosphate and potassium as murate of potash. Farm yard manure prepared with cattle dung, vermicompost with agriculture wastes, cow dung slurry, rock phosphate and earth worms. Panchagavya was prepared with cow dung, cow urine, cow ghee, cow milk,cow curd, jaggary, ripened banana, block grapes, coconut water and groundnut cake. Jeevamrutha was prepared with cow dung, cow urine, chickpea powder, jaggery, and virigin soil. Farmyard manure was applied 3 times in control plots as basal dose before transplanting of seedlings, tillering stage and panicle initiation stage. Vermicompost, Panchagavya, and Jeevamrutha were applied in split doses depending on the treatment type. Jeevamrutha was applied on 15, 30, 45, 60 and 75 days after transplanting (DAT) in treatments of T4, T5, T7, T8,T9 and T10. Panchagavya was applied as foliar spray on 15, 20, 35, 50, 65 and 80 DAT in treatments of T2, T3, T6, T8, T9 and T10. Vermicompost was applied 8 t/ha to the soil in two splits, half dose at transplanting and half at 30 DAT in treatments of T1,T6, T7 and T10.

Sampling and measurement of various parameters

Plant height (cm), number of tillers per hill, flag leaf length (cm), number of panicles per plant, number of grains per panicle, panicle length (cm), kernel length and breadth (mm), grain weight were recorded from each experimental plot. Grain and straw yields per plot converted in to kg/ha. Grain and straw samples were collected at maturity stage. The samples were

sun dried for 3-4 days, after that grinded the samples and used for analysis. Dry mater and ash content were analyzed in grain and straw samples by AOAC 1997 method[2]. The crude protein contents of the straw and grain were analyzed using the Kjaldehl distillation method[2]. Neutral and acid detergent fibre and acid detergent lignin were measured by Van Soest method28 and crude fibre was calculated from ADF by formula of (ADF*0.75) + 3.56[11].

Data Analysis

Data were analyzed with SAS2012[21] using below model:

$$Yij=\mu+ti+bj+(tb)ij+eij$$

Where, Yij represents the j-th cultivar (j = 1, 2, ...ni) on the i-th treatment (i = 1, 2, ..., k levels). So, overall mean effect, ti represents the i-th treatment effect, bj represents jth cultivar effect and tbij is interaction between treatment and cultivar effect, eij represents the random error the errors eij are assumed to be normally and independently (NID) distributed, with mean zero and variance σ2e. SAS 9.2 (2012) statistical package was used for analysis of variance (ANOVA) by general linear model (PROC GLM) procedure for treatment effect, cultivar effect and interaction between treatment and cultivar effect, Comparison of means between treatments was used Fisher's least significance difference (LSD) test at 5% level of significance

Results And Discussion

Many studies have been carried out to observe the impact of different combinations of organic and inorganic fertilizers on quantitative and qualitative parameters of rice. This study has mainly focused to determine the effects of different combinations of organic and inorganic fertilizers on quantitative and qualitative parameters of two cultivars of rice.

Effect on Quantitative and Qualitative Para meters

The data on grain and straw parameters of rice as influenced by the different combinations of organic and inorganic fertilizers presented in table 2. The results showed that treatment effect of organic and inorganic fertilizer was highly significant (P< 0.0001). For the cultivars, grain dry matter (%), crude protein (%) and yield were highly significant (P<0.0001) and straw parameters of ash (%), crude protein (%), crude fibre (%), and yield were also highly significant (P<0.0001). There were no significant effect on grain ash (%) and straw dry matter (%) and acid detergent lignin (%).Simultaneously interaction effect was significant on grain and straw yield and straw acid detergent lignin (P<0.0001).

Effect on Quantitative and Qualitative Parameters of Cultivar DRR Dhan 39

There was significant effect of different fertilizer treatments on quantitative and qualitative parameters of cultivar DRR Dhan 39 (Table 3). Application of (T10) NPK 50% + Vermicompost + Panchagavya 3% +Jeevamrutha 5% gave the significantly higher grain yield of 8713 kg/ha (Fig.1). However, the lowest grain yield was recorded with vermicompost (T1) alone (4440 kg/ha). Whereas, the recommended application of NPK fertilizer to the plots of control 2 was produced the grain yield of 5420 kg/ha. The highest grain dry matter content of 87.84 % was recorded in T10 and lowest dry matter of 86.63 % in T6 treatment. In control 2, dry matter content of 87.35 % was recorded with NPK alone. Grain ash content was higher found in T3 and lowest in T8 treatment, higher crude protein content (CP) observed in control 2 (10.05 %) and lowest crude protein recorded in T4 (8.65 %). The grain dry matter and crude protein were statistically significant at P<0.007and P<0.05 and ash contents were not influenced by the treatments.

Application of (T10) NPK 50% + Vermicompost + Panchagavya 3% +Jeevamrutha 5% gave significantly higher straw yield (9483 kg/ha). However, the lowest straw yield in control 2 was recorded with NPK alone (5480kg/ha). The quality parameters of straw such as DM was higher in T8 (92.57 %) and lowest recorded in T9 (91.23 %), Ash content (Mineral) was observed higher in T8 (20.65 %) and lowest in T5 (18.16 %), Crude protein (CP) higher was recorded in control 2 (5.62 %) and lowest in T2 (4.17 %), neutral detergent fibre (NDF) higher in T10 (69.43 %) and lowest in T3 (65.08 %), acid detergent fiber (ADF) higher in T8 (52.03 %) and lowest in T6 (48.66 %). crude fibre (CF) higher in T8 (44.44 %) and lowest in T6 (40.39 %), acid detergent lignin (ADL) higher in T5 (4.55 %) and

lowest in T3 (3.29 %). ADF, CF, ADL were statistically significant at P<0.008 and, P<0.008 and P<0.0001, respectively.

It is observed that the highest grain yield was recorded with DRR Dhan 39 with the combination of 50 % inorganic fertilizer of NPK 65:75:75 and organic fertilizers of vermicompost, Jeevamrutha5% and Panchagavya 3% (T10).Similar grain yield was obtained with farm yard manure of 20 t/ha. However, the highest straw yield was also recorded with T10 treatment.

Effect on Quantitative and Qualitative Parameters of Cultivar RP. BIO. 226

There was significant effect of different fertilizer treatments on quantity and quality parameters of cultivar RP. BIO. 226 (Table 4). Grain and straw yield was highly significant with different treatments at P<0.0001. The highest grain yield of 6390 kg/ha was obtained with the combination of vermicompost + Jeevamrutha 5% + Panchagavya 3% (T8) and lowest of 3956.7 kg/ha with Panchagavya 5%.(T3). The application of inorganic fertilizer alone produced the grain yield of 4890kg/ha. The grain quality parameters like DM was higher recorded in T6 (88.10 %) and lowest in T1 treatment (86.66 %), ash content higher in control 2 (2.62 %) and lowest in T8 (1.70 %), crude protein higher in T10 (11.82 %) and lowest in control1 (9.88 %). effect of different fertilizers on grain CP was found statistically significant at P<0.003, DM and mineral was not statistically significant.

Application of NPK 50% + Vermicompost + Panchagavya 3%, Jeevamrutha 5% (T10) gave the highest straw yield of 7430 kg/ha (Table 4) and lowest of 5703 kg/ha with NPK alone. The quality parameters of straw, highest NDF was found in T2 (77.47 %) and lowest in T5 (68.63 %), ADF highest in T4 (57.86 %) and lowest in T6 (52.80 %), CF highest in T4 (43.60 %) and lowest in T6 (39.98 %), acid detergent lignin highest in T3 (4.53 %) and lowest in control1 (3.56 %). DM, mineral, CP, and NDF were not influenced statistically. ADF, CF and acid detergent lignin (ADL) were significant at P<0.0003, P<0.0003 and P<0.0004.

The variety RP.BIO.226 produced the highest grain yield with the combination of vermicompost, Jeevamrutha 5% and Panchagavya 3% (T8) which was similar with the use of farm yard manure alone (Control 1). However, this variety gave the highest straw yield with the combination of organic and inorganic manures (T10) which was similar recorded with Jeevamrutha 5% at 500 litres/ha (T4). Both the varieties gave the less grain and straw yield with NPK inorganic fertilizer alone.

These results are inconformity with the findings of the previous studies. Increase in rice yield had been reported from the Indo-Gangetic plain with the use of NPK with manures than NPK alone[29]. Farm yard manure of 10 t/ha with chemical fertilizer increased grain yield by 25% than the yield obtained with inorganic fertilizer application alone which was due to more nutrient uptake resulted in more number of tillers and filled grains[23].In another study, increase in rice yield was recorded when inorganic fertilizer was used along with cow dung and ash in dry season18. Another previous study indicated that application of 100% NPK + farmyard manure significantly increased the grain yield of wheat as compared to the application 100 and 150 % NPK alone[25].Increased stover yield 8-21 and 14-21 % with the application of farm yard manure and inorganic fertilizer and farmyard manure application increased total nitrogen by 21-36 % and grain protein yield by 8-11%[3].

In the literature also found the importance of organic manures like panchagavya and Jeevamrutha. In South India many farmers practice panchagavya for sustainable agriculture[13]. Several organic bio-fertilizers such as Jeevamrutha and Beejamrutha are shown to be effective by enriching the soil for improving the crop yield[27]. The reasons for increase in rice yield due to combining organic and inorganic fertilizers are many folds. This might allow soil organic carbon accumulation and crop productivity in rice fields through increasing N efficiency possibly by enhanced microbial activity. Well-managed, combined organic/inorganic fertilization could both enhance C storage in soils and reduce emission from N fertilizer use, while contributing to high crop productivity in agriculture[15]. In-situ incorporation of dhanincha @ 12.0 t/ha amongst the organic manures recorded higher number of tillers per hill, taller plants, leaf area index, grain and straw yield, dry matter production of rice over no manuring[9,16].

Table 2 :Analysis of variance (ANOVA)

Variable		Grain parameters				Straw parameters							
	DF	DM%	Ash%	CP% kg/ha	Yield	DM%	Ash%	CP%	NDF%	ADF% kg/ha	CF%	ADL%	Yield
Treatment	11	0.1089	0.0250	<0.0001	<0.0001	0.4686	0.1352	0.0080	0.1333	<0.0001	<0.0001	0.0002	<0.0001
Cultivar	1	<0.0001	0.0180	<0.0001	<0.0001	0.3135	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0316	<0.0001
Treatment* cultivar	11	0.0322	0.0962	0.0875	<0.0001	0.4613	0.2000	0.6487	0.8059	0.0290	0.0290	<0.0001	<0.0001

DM: Dry matter, CP: Crude protein, NDF: Neutral detergent fibre, ADF: Acid detergent fibre, CF: Crude fibre, ADL: Acid detergent lignin

Table 3: Effect of different treatments on quantitative and qualitative parameters of cultivar DRR Dhan 39

Treatment	Grain parameters				Straw parameters							
	DM%	Ash%	CP%	Yield kg/ha	DM%	Ash%	CP%	NDF%	ADF%	CF%	ADL%	Yield kg/ha
T1	87.26^{abcd}	1.80^{b}	9.02^{bcd}	4440.0^{g}	92.24^{a}	18.46^{b}	4.83^{abcd}	68.20^{a}	51.37^{b}	42.38^{b}	3.62^{defg}	6870.0^{a}
T2	87.16^{bcde}	2.08^{ab}	8.79^{cd}	6840.0^{dc}	92.10^{a}	19.47^{ab}	4.17^{d}	69.12^{a}	52.12^{ab}	42.96^{ab}	3.57^{fg}	8653.3^{b}
T3	87.67^{ab}	2.83^{a}	9.61^{abc}	6470.0^{cde}	92.08^{a}	20.00^{ab}	4.87^{abcd}	65.08^{a}	51.55^{ab}	42.53^{ab}	3.29^{g}	8533.3^{b}
T4	86.75^{de}	1.45^{bc}	8.65^{d}	6023.3^{def}	91.80^{a}	18.71^{b}	4.28^{cd}	68.57^{a}	53.73^{ab}	44.18^{ab}	4.04^{bcd}	9443.3^{a}
T5	86.77^{de}	1.76^{bc}	9.14^{bcd}	5926.7^{ef}	91.86^{a}	18.16^{b}	5.00^{abcd}	67.04^{a}	48.45^{c}	40.22^{c}	4.55^{a}	8616.7^{b}
T6	86.63^{e}	1.94^{b}	8.86^{cd}	7360.0^{bc}	91.32^{a}	18.17^{b}	4.54^{cd}	66.34^{a}	48.66^{c}	40.39^{c}	4.44^{ab}	7350.0^{de}
T7	86.94^{cde}	1.36^{bc}	9.21^{abcd}	7253.3^{bc}	91.91^{a}	19.17^{ab}	4.85^{abcd}	67.94^{a}	52.03^{ab}	42.90^{ab}	3.89^{cdef}	7866.7^{cd}
T8	86.92^{cde}	0.95^{c}	9.37^{abcd}	7913.3^{ab}	92.57^{a}	20.65^{a}	4.63^{bcd}	68.57^{a}	52.03^{a}	44.44^{a}	4.08^{bc}	7430.0^{d}
T9	87.53^{abc}	1.72^{bc}	9.82^{ab}	7863.3^{ab}	91.23^{a}	19.50^{ab}	5.10^{abc}	68.83^{a}	52.17^{ab}	43.03^{ab}	4.05^{bcde}	7780.0^{cd}
T10	87.84^{a}	1.97^{b}	9.62^{abc}	8713.3^{a}	92.24^{b}	19.22	4.61^{bcd}	69.43^{a}	53.12^{ab}	43.70^{ab}	3.62^{efg}	9483.3^{a}
Control 1	87.42^{abc}	1.68^{bc}	9.20^{abcd}	8350.0^{a}	91.90^{a}	19.00^{ab}	5.40^{ab}	66.63^{a}	52.55^{ab}	43.29^{ab}	4.32^{ab}	8283.3^{bc}
Control 2	87.35^{abcd}	1.80^{b}	10.05^{a}	5420.0^{f}	92.13^{a}	19.43^{ab}	5.62^{a}	65.76^{a}	51.04^{c}	42.14^{bc}	4.06^{bc}	5480.0^{f}
P > F	0.007	0.027	0.05	0.0001	0.47	0.26	0.058	0.900	0.008	0.008	0.0001	0.0001
LSD	0.69	0.82	0.85	904.85					2.84	2.12	0.39	527.1

LSMs of parameters in each column with the same superscript do not differ significantly from each other according to the Student's t test (P <0.0001)

DM: Dry matter, CP: Crude protein, NDF: Neutral detergent fibre, ADF: Acid detergent fibre, CF: Crude fibre, ADL: Acid detergent lignin

Table 4 :Effect of different treatments on quantitative and qualitative parameters of cultivar RP.BIO.226

Treatment	Grain parameters				Straw parameters							
	DM%	Ash%	CP%	Yield kg/ha	DM%	Ash%	CP%	NDF%	ADF%	CF%	ADL%	Yield kg/ha
T1	86.66^{b}	1.85^{b}	10.09^{de}	5266.7^{bcd}	91.74^{a}	18.49^{abc}	3.78^{b}	76.70^{ab}	55.61^{bc}	45.59^{bc}	3.65^{ef}	6223.3^{bcd}
T2	87.27^{ab}	1.93^{b}	10.64^{cde}	4610.0^{def}	91.76^{a}	17.94^{bc}	4.13^{b}	77.47^{a}	54.89^{bcd}	45.05^{cbd}	4.20^{abc}	5660.0^{cde}
T3	87.75^{a}	1.87^{b}	10.06^{de}	3956.7^{f}	91.66^{a}	17.79^{bc}	4.07^{b}	70.10^{cd}	55.36^{bc}	45.40^{bc}	4.53^{a}	4453.3^{fg}
T4	87.82^{a}	1.88^{b}	10.78^{bcde}	4193.3^{ef}	92.28^{a}	18.73^{ab}	4.04^{b}	70.88^{abcd}	57.86^{a}	47.25^{a}	4.23^{abc}	5283.3^{cdef}
T5	87.54^{ab}	1.88^{b}	10.09^{de}	5630.0^{abc}	92.41^{a}	18.30^{abc}	4.52^{ab}	68.63^{d}	53.01^{de}	43.61^{de}	4.20^{abc}	5606.7^{cde}
T6	88.10^{a}	2.23^{ab}	10.36^{cde}	4580.0^{def}	91.97^{a}	17.18^{c}	4.07^{b}	70.31^{bcd}	52.80^{e}	43.47^{e}	4.05^{bcd}	5343.3^{cdef}
T7	88.05^{a}	2.00^{ab}	10.39^{cde}	4620.0^{def}	91.77^{a}	18.13^{abc}	3.99^{b}	72.03^{abcd}	55.45^{bc}	45.46^{bc}	4.02^{cde}	4663.3^{fg}
T8	88.17^{a}	1.70^{b}	11.37^{abc}	6390.0^{a}	91.97^{a}	18.18^{abc}	3.84^{b}	73.71^{abcd}	52.85^{e}	43.50^{e}	3.75^{def}	5503.3^{cde}
T9	88.00^{a}	2.10^{ab}	12.26^{a}	5730.0^{ab}	92.27^{a}	17.67^{bc}	4.61^{ab}	75.87^{abc}	55.00^{bc}	45.11^{bc}	4.35^{abc}	6216.7^{bcd}
T10	87.92^{a}	2.19^{ab}	11.82^{ab}	6040.0^{ab}	92.00^{a}	18.84^{ab}	4.25^{ab}	73.72^{abcd}	56.25^{a}	46.06^{b}	4.41^{ab}	7430.0^{a}
Control1	87.52^{ab}	2.16^{ab}	9.88^{abcd}	6373.3^{a}	91.78^{a}	17.94^{bc}	4.06^{b}	75.90^{abc}	54.68^{cd}	44.89^{cd}	3.56^{f}	6610.0^{bc}
Control2	87.83^{a}	2.62^{a}	11.18^{abcd}	4890.0^{cde}	92.04^{a}	19.42^{a}	5.02^{a}	72.63^{abcd}	55.03^{bc}	45.14^{bc}	4.02^{cd}	5703.3^{efg}
P>F	0.222	0.362	0.003	0.0001	0.641	0.109	0.226	0.207	0.0003	0.0003	0.0004	0.0001
LSD			1.13	798.21					1.54	1.15	0.35	616.16

LSMs of parameters in each column with the same superscript do not differ significantly from each other according to the Student's t test (P <0.0001)

DM: Dry matter, CP: Crude protein, NDF: Neutral detergent fibre, ADF: Acid detergent fibre, CF: Crude fibre, ADL: Acid detergent lignin

Conclusion

Organic fertilizers such as farm yard manure, vermicompost, panchagavya and Jeevamrutha were found to increase the crude protein content in grain and lower the fibre and lignin content in straw, which determine the digestibility of fodder in animals.

On the basis of the results of this study found that combination of organic and inorganic fertilizers not only increases quantitative but also increases qualitative parameters which resulted in higher grain and straw yield of rice cultivars. There is need to conduct further studies to determine the effect of organic and inorganic fertilizer in combination on the crop productivity and soil properties under long term experiments.

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