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Residual and Cumulative Effect of Ipns Practices of Horsegram (*Macrotyloma uniflorum* Lam.) on Growth and Yield of Finger Millet-Horsegram Cropping Sequence

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ABSTRACT

Background: Horsegram is a form of legume that's simple to cultivate, flexible to pests and diseases, attraction to the eye and palate and extensively nutritious. In certain regions, it's grown on lower suitable soil. The integrated plant nutrient system (IPNS) involves managing or maintenance of soil fertility and nutrient levels to ensure they are optimal for achieving the desired crop yield.

Methods: The trail consists of 12 treatments which had been three replicated. The trail layout as the randomized block design layout. The treatments 12 included in the study were T_1- Control (without fertilizers), T_2- 100% RDF (N:P:K) (12.5:25:12.5 kg ha^{-1}), T_3- 75% RN (Chemical fertilizer) + 25% RN (Green leaf manure compost), T_4- 75% RN (Chemical fertilizer) + 25% RN (Groundnut oil cake), T_5- 75% RN (Chemical fertilizer) + 25% RN (Pressmud compost), T_6- 75% RN (Chemical fertilizer) +25% RN (Coirpith compost), T_7- 50% RN (Chemical fertilizer) + 25% RN (Green leaf manure compost) + 25% RN (Groundnut oil cake), T_8- 50% RN (Chemical fertilizer) + 25% RN (Pressmud compost) + 25% RN (Coirpith compost), T_9- 50% RN (Chemical fertilizer) + 25% RN (Greenleaf manure compost) + 25% RN (Pressmud compost), T_{10}- 50% RN (Chemical fertilizer) + 25% RN (Green leaf manure compost) + 25% RN (Coirpith compost), T_{11}- 50% RN (Chemical fertilizer) + 25% RN (Groundnut oil cake) + 25% RN (Press mud compost) and T_{12}- 50% RN (Chemical fertilizer) + 25% RN (Groundnut oil cake) + 25% RN (Coirpith compost).

Result: The outcomes of results revealed that of present study were combine with application of 50% RN through chemical fertilizer + 25% RN through green leaf manure compost + 25% RN through groundnut oilcake (T_7) significantly recorded highest plant height, no. of branches $plant^{-1}$, yield attributes, seed and haulm yield at 30 DAS, 60 DAS and at post-harvest stages, respectively as compared to rest of treatments as well as control (T_1).

Key words: Cropping sequence, Plant height, Yield attributes, Yield.

INTRODUCTION

Horsegram is a essential crop in South India. Its grain is used for human intake as 'dal' as well as in the preparation of so known as 'rasam' and also as a focused feed for livestock (Jayashree and Krishnamma, 2020). It is also knows as poor man's crop of poor resources is widely cultivated in India. Indian regions receiving approximately 200-700 millimeters of rainfall. Consequently, referred to as a drought. Hardy commonly are usually suited to various soil types. Horsegram seed is consumed has a wonderful extremely super food that is consumed widely as a diet. The south-western regions of India. Its incorporates a enormous amount of protein (44%) and also additionally consists of a supply of minerals, notably calcium (28.7%), iron (87.5%) and phosphorus (44.4%) of the total. (Sivakumar *et al*., 2023). A number of the numerous pulses cultivated in India, it occupies the third position in terms of the area it covers, with 17.02 lakhs hectares with 7.19 lakh tonnes of annual production. The moderate productivity of horse gram across the country stands at 494 kilograms per hectare (Suthar *et al*., 2017). A temperature range of 20-35°C. It's miles usually adapted to a huge sort of soils, inclusive of deep red, loam, black cotton soils, clayey paddy soils, sandy and shallow soils, stony and gravelly uplands, wiped clean hard forests and so forth.

Consequently, the type of soil isn't always bar to horsegram cultivation. It's for grown as a sole crop and in

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multitudinous combination. it's also used as food, fodder and traditional medicines specifically to deal with kidney stones, bronchial asthma, bronchitis, leucoderma, urinary releases, coronary heart illnesses and ulcers and moreover beneficial in balancing blood sugar levels in diabetic cases because of the presence of useful bioactive combinations (Aditya *et al*., 2019). Horsegram contributes about 0.33% of the complete food grain product in India. it's far an extremely good deliver of protein (up to 25%), carbohydrates (60%), essential amino acids, power, nutritional fibers (5.3%), low content of lipid (0.58%), molybdenum, iron, riboflavin (0.2 mg) and niacin (1.5 mg) for 100 g of dry remember (Naik and Parida, 2021). Horsegram is one similar legume, which is easy to grow, evidence towards pests and diseases, attraction to the attention and is pretty nutritious. Although it's far nutritional and useful to us its cultivation is unnoticed. In some regions, it's far cultivated in marginal land. It's far critical to take again of it and make aware human beings of its price and inspire its production with the aid using advanced generation.

In destiny, it will occupy a special characteristic in the pulse organization even though it is left out nowadays. From the manufacturing and nutritive issue of view improvement of pulses can most effective be executed whilst minor pulses like horsegram convey underneath cultivation with proper packaging and practices (Purushottam *et al*., 2017). With the aid optimizing the benefits from all potential resources of plant vitamins in an included way, the Integrated Plant Nutrient System (IPNS) maintains or adjusts soil fertility and plant nutrient delivery to the highest level for maintaining the preferred crop productivity. Depending on the land use system and the ecological, social and economic circumstances, different combinations of mineral fertilizers, organic manures, crop wastes, composts, or N-fixing crops are suitable. There is little information available about nutrient control at the finger millet-horsegram cropping sequence.

MATERIALS AND METHODS

The trail of the experiment was conducted at the farm land, Valiyampattu, Sankarapuram, Kallakurichi, Tamil Nadu to study impact of organic and inorganic growth and yield horsegram of residual and cumulative effect on Paiyur-1 duration 110 DAT as test crop in *rabi*, 2022. The test was laid out in RBD (randomized block design) with twelve treatments replicated thrice using different sources of composts, Green leaf manure compost (GLMC), Groundnut oilcake (GOC), Pressmud compost (PMC) and Coirpith compost (CPC), had been applied as basal on N equal basis and NPK fertilizers. Residual effect of various levels and different combinations of chemical fertilizers and composts fertilizer applied to the first crop in the cropping sequence finger millet and subsequent crop was raised same plot as residual crop. In the experiment, horsegram was raised and the test was carried out without utility of inorganic fertilizers and composts source of nutrient from before crop in fingermillet. The initial soil of the experiment comprised of 33.22 in keeping with cent coarse sand, 26.19 consistent with cent fine sand, 22.25 per cent silt and 17.67 per cent clay. Hence it was classified sandy loam texture. The soil belonged to the Pachol (Phl) series, Entisol in order. The taxonomic class of the soil became *Paralithic Ustorthent*. The density (bulk density and particle density), pore space and water holding capacity (WHC) of the initial soil were 1.47 Mg m^{-3}, 2.21 Mg m^{-3}, 33.48 and 23.27 per cent, respectively. The soil color was 5YR 5/4 based on Munsellcolor chart. The soil registered organic carbon content, pH and electrical conductivity and of 2.86 g kg^{-1}, 7.27 and 0.33 dSm^{-1} and respectively. Horsegram RDF (60:30:30 kg ha^{-1} of NPK) had been applied field the sources of Urea, SSP and MOP, respectively. The field experiment was conducted in accordance with the treatment schedule to examine the cumulative effect of varying concentrations of inorganic fertilizers and composts on horsegram. The 12 treatment were T_1- Control (without fertilizers), T_2- 100% RDF (N:P:K)(12.5:25:12.5.kg ha^{-1}), T_3- 75% Recommended Nitrogen (Chemical fertilizer) +25% Recommended Nitrogen (Green leaf manure compost), T_4- 75% Recommended Nitrogen (Chemical fertilizer) + 25% Recommended Nitrogen (Groundnut oil cake), T_5- 75% Recommended Nitrogen (Chemical fertilizer) + 25% Recommended Nitrogen (Pressmud compost), T_6- 75% Recommended Nitrogen (Chemical fertilizer) + 25% Recommended Nitrogen (Coirpith compost), T_7- 50% RN(Chemical fertilizer) + 25% Recommended Nitrogen (Green leaf manure compost) + 25% Recommended Nitrogen (Groundnut oil cake), T_8- 50% Recommended Nitrogen (Chemical fertilizer) + 25% Recommended Nitrogen (Pressmud compost) + 25% Recommended Nitrogen (Coirpith compost), T_9- 50% Recommended Nitrogen (Chemical fertilizer) + 25% Recommended Nitrogen (Green leaf manure compost) + 25% Recommended Nitrogen (Pressmud compost), T_{10}- 50% Recommended Nitrogen (Chemical fertilizer) + 25% Recommended Nitrogen (Green leaf manure compost) + 25% Recommended Nitrogen Coirpith compost, T_{11}- 50% Recommended Nitrogen (Chemical fertilizer) + 25% Recommended Nitrogen (Groundnut oil cake) + 25% Recommended Nitrogen (Press mud compost) and T_{12}- 50% Recommended Nitrogen (Chemical fertilizer) + 25% Recommended Nitrogen (Groundnut oil cake) + 25% Recommended Nitrogen (Coirpith compost), respectively.

Statistical analysis

The analysis of variance technique for randomized block design proposed by Gomez and Gomez (1984) was used to statistically examine the data on the observations. The significance was assessed using the F-test at the 5% level of probability and the crucial difference (CD) was calculated in cases where the "F" value was deemed significant.

RESULTS AND DISCUSSION

Plant height

Residual effect of 50% RN (chemical fertilizer) + 25% RN (green leaf manure compost) + 25% RN (Groundnut oil cake) (T_7) registered plant height at 30, 60 DAS and at harvest were 26.3, 38.1 and 49.8 cm, respectively presented within the Table 1. The treatment (T_7) was followed by T_{11} registered plant height of 24.9, 36.4 and 47.3 cm, respectively were on par with T_2 recorded 24.0, 35.4 and 46.1 cm at 30, 60 DAS and at harvest, respectively. However lowest horsegram plant height at 30, 60 and at harvest ranges has been 12.9, 23.2 and 25.8, respectively. Cumulative effect of 50% RN (Chemical fertilizer) + 25% RN (Green leaf manure compost) + 25% RN (Groundnut oil cake) (T_7) registered appreciably highest plant height at 30, 60 DAS and at harvest were 38.1, 40.7 and 57.4 cm, respectively. The treatment T_{11} and T_2 were registered plant height at.30, 60 DAS and at harvest were 36.0, 38.1 and 53.3 and 35.1, 37.1 and 52.1, respectively. T_{11} was similar with T_2. The treatments T_9 and T_{10}, T_8 and T_3 were also non-significant. The residual effect horsegram on plant height was conspicuous inside the succeeding horsegram as well and the trend of results changed into just like that of the primary crop. The present result concurred with Joshi *et al.* (2015). Increasing the plant height within the fallow crops because of residual and cumulative plant merger with the focused organic manure and inorganic sources brought about higher growth, ensuing in better yields in horsegram. During the initial phase of plant development, inorganic fertilizers provide effortlessly accessible nutrient sources, while oilcake releases nutrients through mineralization, a process that necessitates time for plant uptake of developing the plant peak inside the fallow plants life way to residual and cumulative vegetation because of higher boom beneath the mixture of concentrated natural manure and inorganic fertilizer treatments ended in higher yield contributing characters in horsegram. Within the early stage of plant boom, inorganic fertilizers provide without problems available kinds of vitamins at the same time as oilcake released nutrients as undergoes mineralization which requires time for usage through plants of sorghum-chickpea cropping sequence. Chhatwani *et al.* (2022); Kamal *et al.* (2021) and Hoque *et al.* (2018).

No. of branches plant^{-1}

The treatment of 50% recommended dose of nitrogen (C.F) + 25% recommended dose of nitrogen (GLMC) + 25% recommended dose of nitrogen (GOC) residual effect recorded considerably maximum no. of branches plant^{-1} at 30, 60 DAS and at harvest stages were 2.94, 5.54 and 7.32, respectively confirmed in the Table 2. The treatment T_{11} registered 2.74, 5.20 and 7.06 were found to be with non-

Table 1: Effect on residual and cumulative sources of organic and inorganic fertilizers on plant height (cm) at different DAS of horsegram. cv. Paiyur-1 in finger millet-horsegram cropping sequence.

T. no.	Treatments details	Residual effect			Cumulative effect		
		30 DAS	60 DAS	Harvest	30 DAS	60 DAS	Harvest
T_1	Absolute control	12.9	23.2	25.8	12.9	23.3	25.8
T_2	100% Recommended dose of fertilizer (N:P:K) (12.5:25:.12.5 kg ha^{-1})	24.0	35.4	46.1	35.1	37.1	52.1
T_3	75% RN + 25% RN (Green leaf manure compost)	16.7	27.3	32.1	20.2	26.0	35.3
T_4	75% RN + 25% RN (Groundnut oil cake)	23.3	34.6	44.6	33.8	36.3	50.8
T_5	75% RN + 25% RN (Press mud compost)	20.2	30.9	38.9	28.4	32.0	43.7
T_6	75% RN (Chemical fertilizer) + 25% RN (Coir pith compost)	15.4	25.8	29.5	17.7	23.4	31.6
T_7	50% RN (Chemical fertilizer) + 25% RN (Green leaf manure compost) + 25% RN (Groundnut oil cake)	26.3	38.1	49.8	38.1	40.7	57.4
T_8	50% RN (Chemical fertilizer) + 25% RN (Press mud compost) + 25% RN (Coir pith compost)	17.3	27.7	33.2	21.9	26.6	36.3
T_9	50% RN (Chemical fertilizer) + 25% RN (Green leaf manure compost) + 25% RN (PMC)	21.9	32.7	41.6	31.2	33.6	47.1
T_{10}	50% RN (Chemical fertilizer) + 25% RN (Green leaf manure compost) + 25% RN (Coir pith compost)	21.1	31.7	40.6	29.9	32.8	45.1
T_{11}	50% RN (Chemical fertilizer) + 25% RN (Groundnut oil cake) + 25% RN (Press mud compost)	24.9	36.4	47.3	36.0	38.1	53.3
T_{12}	50% RN (Chemical fertilizer) + 25% RN (Groundnut oil cake) + 25% RN (Coir pith compost)	18.7	29.2	35.9	25.4	29.2	40.1
	S.Ed	0.63	0.73	1.17	0.95	1.13	1.60
	CD (p=0.05)	1.28	1.47	2.36	1.92	2.27	3.24

- RN- Recommended Nitrogen.

significant with T_2 recorded 2.66, 5.11 and 7.01 at the above respected stages. However, control (T_1) recorded lowest number of branches plant^{-1} at 30, 60 DAS and at harvest stages have been 1.49, 3.51 and 5.12, respectively. The combination of 50% Recommended Nitrogen (from Chemical Fertilizer), 25% Recommended Nitrogen (from Green Leaf Manure Compost) and 25% Recommended Nitrogen (from Groundnut Oilcake) resulted in a significantly greater number of branches per plant at 30, 60 days after sowing and at harvest, with counts of 4.67, 7.18 and 9.43, respectively. The treatment T_{11} showed similar consequences to T_2. The treatment T_3, which consisted of 50% Recommended Nitrogen (Chemical Fertilizer) combined with 25% Recommended Nitrogen (Green leaf manure compost), recorded the number of branches per plant at 60 DAS and at harvest stages as 2.89, 5.14 and 6.67, which were not significantly different from T8, which included 50% Recommended Nitrogen (Chemical Fertilizer), 25% Recommended Nitrogen and 25% Recommended Nitrogen (Coirpith compost), that had values of 3.04, 5.32 and 6.79, respectively. However, lowest no. of branches plant^{-1} at 60 DAS and at harvest stages was. 2.12, 4.25 and 5.83, respectively. This might be due to high charge of mineralization of organic nitrogen due to lowering the C:N ratio by way of including and more availability of organic carbon for the multiplication of microorganisms and this helped in improving the nutrient availability in soil by using developing microbial activities. The results are in close conformity with those of Rajiput and Kushwah (2005) and Karande *et al.* (2007). The use of organic matter in soil has been shown to improve the plant increase parameters (Hou *et al.*, 2013). It may be attributed to the fact that improved nutrient availability through these treatments brought about a higher conversion of carbohydrates into protein, which subsequently produced protoplasm and cell wall components, thereby increasing cell size. This morphological alternate manifested in terms of plant height, the number of branches and ultimately, dry matter accumulation (Thesiya *et al.*, 2019).

Yield attributes

Application of 50%RN(Chemical fertilizer) + 25% RN(Green leaf manure compost) + 25% RN (Groundnut oil cake) (T_7) residual effect of significantly improved no. of pods plant^{-1}, no. of seeds pods^{-1}, pod length and test weight of horsegram were 38.7, 7.26, 6.28 cm and 3.44 g compared to control registered 20.2, 3.28, 3.83 cm and 3.25 g, respectively (Table 3). The treatment T_{11} recorded no. of pods plant^{-1}, no. of seeds pods^{-1}, pod length and test weight were 36.8, 6.94, 5.99 cm and 3.42 g were on par with T_2 registered 36.5, 6.82, 5.87 cm and 3.42 g, respectively.

Table 2: Effect on residual and cumulative sources of inorganic fertilizers and composts on number of branches plant^{-1} at different stages of horsegram cv. Paiyur-1 in finger millet-horsegram cropping sequence.

T. no.	Treatments details	Residual effect			Cumulative effect		
		30 DAS	60 DAS	Harvest	30 DAS	60 DAS	Harvest
T_1	Absolute control	1.49	3.51	5.12	2.12	4.25	5.83
T_2	100% Recommended dose of fertilizer (N:P:K) (12.5:25:12.5 kg ha^{-1})	2.66	5.11	7.01	4.33	6.69	8.77
T_3	75% RN + 25% RN (Green leaf manure compost)	1.89	4.08	5.79	2.89	5.14	6.67
T_4	75% RN + 25% RN (Groundnut oil cake)	2.60	5.06	6.94	4.24	6.61	8.62
T_5	75% RN + 25% RN (Press mud compost)	2.31	4.75	6.56	3.75	6.10	7.74
T_6	75% RN (Chemical fertilizer) + 25% RN (Coir pith compost)	1.68	3.80	5.48	2.50	4.69	6.24
T_7	50% RN (Chemical fertilizer) + 25% RN (Green leaf manure compost) + 25% RN (Groundnut oil cake)	2.94	5.43	7.32	4.67	7.18	9.43
T_8	50% RN (Chemical fertilizer) + 25% RN (Press mud compost) + 25% RN (Coir pith compost)	1.94	4.21	5.88	3.04	5.32	6.79
T_9	50% RN (Chemical fertilizer) + 25% RN (Green leaf manure compost) + 25% RN (PMC)	2.41	4.84	6.67	3.92	6.26	8.10
T_{10}	50% RN (Chemical fertilizer) + 25% RN (Green leaf manure compost) + 25% RN (Coir pith compost)	2.38	4.79	5.61	3.85	6.19	7.91
T_{11}	50% RN (Chemical fertilizer) + 25% RN (Groundnut oil cake) + 25% RN (Press mud compost)	2.74	5.20	7.06	4.38	6.80	8.95
T_{12}	50% RN (Chemical fertilizer) + 25% RN (Groundnut oil cake) + 25% RN (Coir pith compost)	2.12	4.49	6.24	3.40	5.75	7.28
	S.Ed	0.07	0.10	0.11	0.12	0.14	0.18
	CD (p=0.05)	0.15	0.20	0.23	0.26	0.30	0.38

• RN- Recommended nitrogen.

Table 3: Effect on residual and cumulative sources of inorganic fertilizers and composts on yield attributes of horsegram cv. Paiyur-1 in finger millet-horsegram cropping sequence.

T. no.	Treatments details	Residual effect				Cumulative effect			
		No. of pods plant^{-1}	No. of seeds pod^{-1}	Pod length (cm)	Test weight (g)	No. of pods plant^{-1}	No. of seeds pod^{-1}	Pod length (cm)	Test weight (g)
T_1	Absolute control	20.2	3.28	3.83	3.25	20.4	3.39	3.83	3.33
T_2	100% Recommended dose of fertilizer (N:P:K) (12.5:25:12.5 kg ha^{-1})	36.5	6.82	5.87	3.41	39.6	8.74	7.26	3.46
T_3	75% RN+ 25% RN (Green leaf manure compost)	26.4	4.92	4.43	3.29	30.2	6.47	5.15	3.34
T_4	75% RN + 25% RN (Groundnut oil cake)	30.6	6.49	5.12	3.34	34.6	7.55	6.90	3.44
T_5	75% RN + 25% RN (Press mud compost)	28.3	5.65	4.71	3.31	32.3	6.88	6.06	3.40
T_6	75% RN (Chemical fertilizer) + 25% RN (Coir pith compost)	24.5	4.63	4.14	3.27	25.1	6.05	4.80	3.36
T_7	50% RN (Chemical fertilizer) + 25% RN (Green leaf manure compost) + 25% RN (Groundnut oil cake)	38.7	7.26	6.28	3.44	42.1	9.37	7.73	3.49
T_8	50% RN. (Chemical fertilizer) + 25% RN (Press mud compost) + 25% RN(Coir pith compost)	30.8	5.03	5.23	3.36	35.0	7.76	5.36	3.37
T_9	50% RN (Chemical fertilizer) + 25% RN (Green leaf manure compost) + 25% RN(PMC)	34.6	6.14	5.59	3.39	37.5	8.31	6.55	3.42
T_{10}	50% RN (Chemical fertilizer) + 25% RN (Green leaf manure compost) + 25% RN (Coir pith compost)	32.7	6.00	5.51	3.38	37.2	8.19	6.42	3.41
T_{11}	50% RN (Chemical fertilizer). + 25% RN (Groundnut oil cake) + 25% RN (Press mud compost)	36.8	6.94	5.99	3.42	40.0	8.95	7.38	3.47
T_{12}	50% RN (Chemical fertilizer) + 25%. RN (Groundnut oil cake) + 25% RN (Coir pith compost)	28.2	5.32	4.84	3.32	32.5	7.12	5.70	3.39
	S.Ed	0.90	0.11	0.10	NS	1.01	0.18	0.15	NS
	CD(p=0.05).	1.82	0.24	0.21	NS	2.05	0.38	0.31	NS

• RN- Recommended Nitrogen.

Similarly T_9 and T_{10} were comparable with each other. Cumulative effect in confirmation trial suggests that application of 50% Recommended Nitrogen (Chemical. fertilizer) + 25% Recommended Nitrogen (Green leaf manure. compost) + 25% Recommended Nitrogen (Groundnut oil cake) (T_7) significantly increased no. of pods plant^{-1}, no. of seeds pods^{-1}, pod length and test weight of horsegram have been 42.1, 9.37, 7.73 cm and 3.49 g than control (T_1) recorded lowest values were 20.4, 3.39, 3.83 and 3.33, respectively. The treatment of 100% RDF (12.5:25:12.5 kg ha^{-1}) recorded number of pods per plant, number of seeds per pods, pod length and test weight were 39.7, 8.74, 7.26 cm and 3.46 g, respectively. However, the treatments T_{11} and T_2, T_9 and T_{10}, T_8 and T_3 has been found to be non-significant. Residual effect and cumulative effect of incorporation of inorganic and organic fertilizer on yield attributes were conspicuous in the finger millet-horsegram sequence and maximum augmentation turned into recorded in residual yield attributes of horsegram and higher yield attributes were found in cumulative studies in the treatment which obtained 50% recommended nitrogen through chemical fertilizer, 25% recommended nitrogen through Green leaf manure compost and 25% recommended nitrogen through groundnut oil cake (T_7). Using of soil organic amendments is probably because of the expanded availability of nutrients for plants, in addition to enhanced water retention capabilities and various physical properties that may have led to improved infiltration rates. This may also be attributed to the development of more root nodules, increased root growth and enhanced nitrogen fixation (Shete *et al.*, 2010). Enhanced plant growth consequences are because of improved photosynthetic activity and the effective movement of photosynthates to the sink, which ultimately leads to improved yield attributes of the plant (Ravikumar *et al.*, 2012; Nath *et al.*, 2020; Chhatwani *et al.*, 2022).

Seed yield

Residual effect of 50% Recommended nitrogen (Chemical fertilizer) + 25% Recommended nitrogen (Green leaf manure compost) + 25% Recommended nitrogen (Groundnut oil cake) (T_7) registered significantly highest seed yield of 579.3 kg ha^{-1} compared to control (T_1) (318.9 kg ha^{-1}). The treatments T_{11} was similar with T_2 registered seed yield of 561.9 and 556.6 kg ha^{-1}, respectively. However, lowest seed yield of 318. 9 kg ha^{-1} was recorded with control (T_1) (Table 4). Cumulative study, application of 50% Recommended nitrogen through chemical fertilizer combined with 25% Recommended nitrogen through green leaf manure compost and 25% Recommended nitrogen through groundnut oil cake (T_7) registered significantly

Table 4: Effect on residual and cumulative sources of inorganic fertilizers and composts on yield (kg ha^{-1}) of horsegram cv. Paiyur-1 in finger millet-horsegram cropping sequence.

T. no.	Treatments details	Residual effect		Cumulative effect	
		Seed yield (kg ha^{-1})	Halum yield (kg ha^{-1})	Seed yield (kg ha^{-1})	Halum yield (kg ha^{-1})
T_1	Absolute control	318.9	1357.4	319.3	1358.3
T_2	100% Recommended. dose of fertilizer (N:P:K) (12.5:25:12.5 kg ha^{-1})	556.6	1824.6	643.4	2045.6
T_3	75% RN + 25% RN (Green leaf manure compost)	464.6	1645.9	518.3	1684.3
T_4	75% RN + 25% RN (Groundnut oil cake)	506.5	1722.5	620.3	1977.4
T_5	75% RN + 25% RN (Press mud compost)	481.9	1677.8	570.5	1827.5
T_6	75% RN (Chemical fertilizer) + 25% RN (Coir pith compost)	448.3	1641.9	493.7	1610.7
T_7	50% RN (Chemical fertilizer) + 25% RN (Green leaf manure compost) + 25% RN (Groundnut oil cake)	579.3	1868.7	669.8	2132.1
T_8	50% RN (Chemical fertilizer) + 25% RN (Press mud compost) + 25% RN (Coir pith compost)	513.8	1733.2	524.5	1791.7
T_9	50% RN (Chemical fertilizer) + 25% RN (Green leaf manure compost) + 25% RN (PMC)	539.3	1789.2	597.9	1908.0
T_{10}	50% RN (Chemical fertilizer) + 25% RN (Green leaf manure compost) + 25% RN (Coir pith compost)	533.1	1772.4	592.7	1888.9
T_{11}	50% RN (Chemical fertilizer) + 25% RN (Groundnut oil cake) + 25% RN (Press mud compost).	561.9	1832.3	648.7	2067.2
T_{12}	50% RN (Chemical. fertilizer) + 25% RN. (Groundnut oil cake) + 25% RN (Coir pith compost)	489.2	1684.3	546.7	1759.1
	S.Ed	7.58	28.0	10.1	31.8
	CD (p=0.05)	15.1	56.0	20.2	63.6

• RN- Recommended nitrogen.

highest seed yield of 669.8 kg ha^{-1} compared to control (T_1) (319.3 kg ha^{-1}). The treatment application of half percent recommended nitrogen (Chemical fertilizer) + 25% recommended nitrogen (Groundnut oil cake) + 25% Recommended nitrogen (Pressmud compost) (T_{11}) registered the seed yield of 648.7 kg ha^{-1} it was similar with T_2 registered seed yield of 643.4 kg ha^{-1}, respectively. However, lowest seed yield. of 319.3 kg ha^{-1} was recorded with control (T_1). An increase in grain yield because of composts with fertilizers is probably because of development in soil fertility recognition, soil natural, microbial and enzyme activity and bodily situations through the slow release of nutrients during composts decomposition and from groundnut oilcake and green leaf manure compost by using of preceding finger millet crop and therefore improved nutrient uptake. The growth in grain yield due to nitrogen application is probably ascribed to the enhancing in dry depend manufacturing, improving increase charge, selling elongation of internodes and hobby of growth hormones like gibberellins (Gewaily *et al.*, 2018). The increase in grain yields may be attributed to the application of higher quantities of vital nutrients, leading to improved vitamin uptake by the crops, which in turn promotes better growth and dry matter accumulation. Comparable consequences were said by means of using Ramesh *et al.* (2009). Addition of organic manures progressed nutrient availability, soil organic carbon, soil physical condition and enzymes activity (Islam *et al.*, 2015).

Haulm yield

Recommended 50% of nitrogen (CF) along with 25% Recommended nitrogen through green. leaf manure compost and 25% Recommended nitrogen through groundnut oil cake (T_7) registered significantly.maximum haulm yield of 1868.7 kg ha^{-1} changed into similar with 1832.3, 1824.6, 1789.2 and 1772.4 kg ha^{-1} had been observed in T_{11}, T_2, T_9 and T_{10}, respectively inside the residual study (Table 4). The treatments T_{11} and T_2, T_9 and T_{10} have been found to be non-significant. However, control recorded lowest haulm yield of 1357.4 kg ha^{-1} in horsegram. Enrichment of the compost because most of the vitamins in the compost can be uptake by using manner of flora effortlessly (Bilkis *et al.*, 2018; Naorem, 2018; Hoque *et al.*, 2018; Moe *et al.*, 2019). In the cumulative study, application of .50% Recommended nitrogen (Chemical fertilizer) + 25% Recommended nitrogen (Green leaf manure compost) + 25% Recommended nitrogen (Groundnut oil cake) (T_7) significantly maximum haulm yield of 2132.1 kg ha^{-1} was followed by 2067.2, 2045.6 kg ha^{-1} had been found to be with T_{11} and T_2, respectively. Among the treatment T_{11} was similar with T_2. Treatment T_9 and T_{10} were similar with each other. The treatments. T_3, T_4 and T_5 registered haulm yield of horsegram have been 1684.3, 1977.4 and 1827.5 kg ha^{-1}, respectively. However, lowest haulm yield of 1358.3 kg ha^{-1} was observed in control (T_1). The cumulative effect of composts and inorganic fertilizers mixture improved significantly more haulm yield than residual impact in 2022. It is obvious that composts and fertilizers combination carried out to horsegram in similarly to the previous finger millet (cumulative effect) within the maximum effects than the ones achieved to the ones carried out to best previous horsegram (residual). This might be because of organics being implemented, nutrients will be launched slowly and additionally the nutrient losses can be minimized. due to improved absorption of nutrients due to expanded cation exchange capability that improved with natural depend application (Khan *et al.,* 2013 and Shukla *et al.*, 2013). In the cumulative study, the treatment application of 100% RDF inorganic fertilizer increased better grain yield and haulm yield as compared to without fertilizer application and inorganic fertilizers in residual effect (Shete *et al.*, 2010). A better yield within the aforementioned treatments is a result of more suitable photosynthesis charge and efficient transport of photosynthates, leading to an increased number of pods. This improvement could also be attributed to a significant increase in the size of the sink, which is the number of pods. The rise in pod size is probably a result of an increase in the number of branches on each plant, which subsequently leads to the formation of additional reproductive structures and, ultimately, a extra sink size, therefore enhancing the overall seed yield (Shariff *et al.*, 2017).

CONCLUSION

From the study residual and cumulative studies, the results clearly revealed that the treatment (T_7) significantly registered the highest plant height, no. of branches plant^{-1}, yield attributes and yield in horsegram cv. Paiyur-1, respectively. Hence, it is inferred from the present study that integrated application of 50%. Recommended dose of nitrogen through inorganic fertilizers + 25% recommended dose of nitrogen through green leaf manure compost + 25% recommended dose of nitrogen through groundnut oilcake under IPNS technology would greatly benefit for the farmers to realize higher productivity, profitability and soil sustainability in finger millet-horsegram cropping sequence.

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Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

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