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Effect of foliar nutrition on nutrient uptake and yield of rice fallow cow pea southern zone of Tamil Nadu

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Abstract
A field experiment was conducted to study the effect of foliar nutrition on Yield attributes and yield of rice fallow Cow pea at College Of Agricultural Technology, Kullapuram, Theni, during *summer*, 2018. These treatments consist of different organic and inorganic foliar nutrition's were applied. Results revealed that the higher nutrient uptake of major nutrients *viz.*, N,P and K were noticed in rice fallow cowpea due to the application of recommended NPKS + 2% DAP + 2% Seaweed Liquid Fertilizer (T_6) compared to rest of the treatments.

Keywords: Foliar nutrition, cow pea, yield, sea weed liquid fertilizer, poly feed and panchakavya

Introduction
Pulses are the important sources of proteins, vitamins and minerals. Ever since farmers started cultivation of rice, growing legumes in rice-fallow has also been under practice in wetland ecosystem wherein it is raised either as relay cropping in the standing crop of rice at 7-10 days before its harvest by broadcasting method or manual dibbling randomly immediately after rice harvest so as to efficient utilization of residual moisture and nutrients left out by the preceding rice. It is also called relay crop or zero tilled crop or residual crop. Further, rice fallow pulse cropping system would sustain the returns to the growers by fetching more price than cereals in spite of lower yields particularly poverty- striken small farmers also improve the sustainability of rice production system (Bastia *et al*., 2008 [3]. In Tamil Nadu rice fallow pulses contribute 40-50 per cent of total pulse production in which blackgram, greengram occupies a major share. The productivity of rice fallow black gram is always far below than it's normal cultivation (Sasikala *et al*., 2014) [15]. The main reasons for low productivity are poor plant population, poor nutrient and moisture stress under critical stages. Jothinayagi and Anbazhagan (2009) [7] reported that lower concentration (20%) of Seaweed Liquid Fertilizer (SLF) of *Sargassum wightii* extract promoted the shoot length, root length, fresh weight, dry weight, chlorophyll, carotenoid, protein, amino acid, reducing sugar, total sugar, α- amylase and β-amylase activities in *Abelmoschus esculentus*. Keeping this view, the present study was taken to assess the residual effect of foliar nutrition on nutrient uptake and yield of rice fallow Cow pea during *summer* 2018.

Proper nutrient management is an important factor to be considered for sustaining pulse productivity. Among the methods of fertilizer application, foliar nutrition is recognized as an important method of fertilization, since foliar nutrients usually penetrate the leaf cuticle or stomata and enters the cells facilitating easy and rapid utilization of nutrients. Among them foliar application of major nutrients like urea, DAP, KCl and use of growth regulators are the potent force in improving the growth, flower initiation, pod setting, seed quality and yield of pulse.Keeping this view, the present study was taken to assess the residual effect of foliar nutrition on nutrient uptake and yield of rice fallow cow pea during *summer* 2018.

Materials and Methods
A field experiment was conducted on "effect of foliar nutrition on nutrient uptake and yield of rice fallow Cow pea during *summer* 2018 at College of Agricultural Technology, Kullapuram, and Theni and belongs to the Southern agro climatic zone of Tamil Nadu. The experimental site is situated at 10 º5' North latitude and 77 º 5' East longitude at an altitude of 540 m from Mean Sea Level. Cowpea variety (CO 7) was selected as a test crop.

The experiment comprised of 9 treatment combinations with DAP (2%), urea (2%), TNAU Pulse Wonder (2 kg), Humic acid (2%), Panchagavya (2%), Seaweed Liquid Fertilizer (2%), PPFM (1%) and Polyfeed (1%) which are laid out Randomized Block Design (RBD) with three replications. The treatment details are T_1- NPKS + 2% DAP; T_2 – T_1 + 2% urea; T_3 - T_1+ TNAU Pulse Wonder (2 kg); T_4- T_1 + 2% Hemic acid; T_5- T_1 + 2 % Panchagavya; T_6- T_1 + Seaweed Liquid Fertilizer (2 %); T_7- T_1 + PPFM (1%); T_8- T_1 + Polyfeed (1%); T_9- NPKS alone. Soil available nutrients (NPK), soil pH and EC determined by standard procedures laid out by Jakson (1973) [6]. Fischer's method of analysis of variance was used for analysis and interpretation of the data as outlined by Panse and Sukhatme (1985) [13]. Nutrient uptake was calculated by following formula.

$$\text{Nutrient uptake (Kg ha}^{-1}) = \frac{\text{Nutrient content (\%)} \times \text{Dry matter production (kg ha}^{-1})}{100}$$

Dry matter production and NPK uptake by rice fallow cowpea

The data pertaining to the dry matter production and uptake of NPK by rice fallow cowpea as influenced by various treatments effects are presented in Table 1.The higher dry matter production was obtained with the application of + 2% DAP along with Seaweed Liquid Fertilizer (T_6) of 32 g plant^{-1}, followed by 31.1 g plant^{-1} when treated with NPKS + 2% DAP along with 2% Humic acid and lower dry matter production was 26 g plant^{-1} was obtained in treatment of NPKS alone.

Periodical spray of macro and micronutrients in the form of microsol might have increased the cytokinin content, which is known for delayed leaf senescence resulting in prolonged retention of the effective photo assimilatory surface like leaf area index. These results are in line with the findings of Kalarani *et al*. (1994) [8]; Kalpana and Krishnarajan (2003) [9] and Manivannan *et al*. (2003) [11].

Results and Discussion

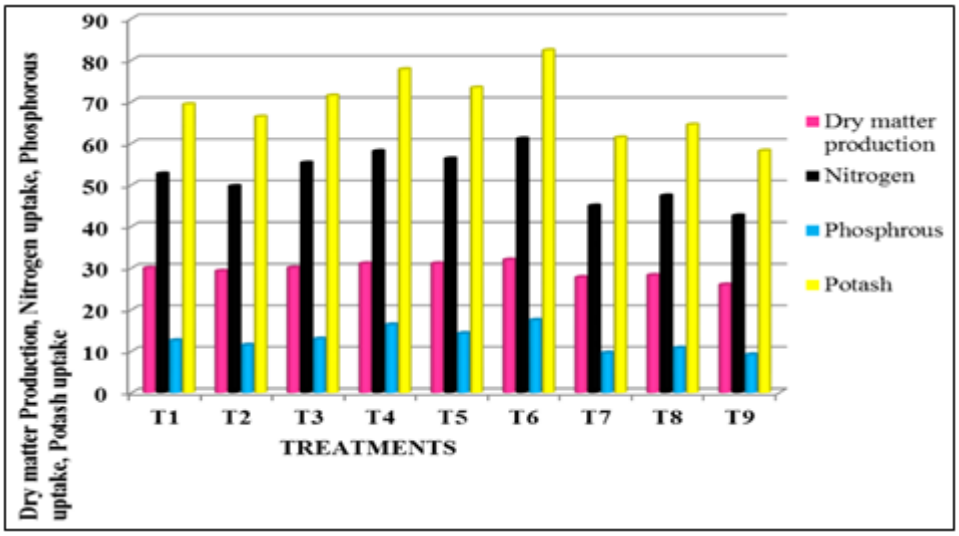

Fig 1: Effect of foliar nutrition on Dry matter production (g/plant), Nitrogen uptake (Kg ha^{-1}), Phosphorous ptake (Kg ha^{-1})

At harvest, application of NPKS + 2% DAP along with Seaweed Liquid Fertilizer showed significant higher N uptake of 61.1 kg ha^{-1}, P uptake of 17.5 kg ha^{-1} and K uptake of 82.4 kg ha^{-1} followed by 58.1 kg ha^{-1}, 16.4 kg ha^{-1} and 77.8 kg ha^{-1} when treated with NPKS + 2% DAP along with 2% Humic acid and significantly lower N uptake by rice fallow cowpea is 42.6 kg ha^{-1}, P uptake is 9.2 kg ha^{-1} and K uptake is 582 kg ha^{-1} which was recorded in T_9 (NPKS alone).

The dry matter production increased as the growth proceeds and maximum value was observed at harvest. Dry matter production is the sum total effect of overall growth like plant height, leaf area, and leaf area index indicating higher chlorophylic area with improved Photosynthetic efficiency of plants which inturn resulted in higher dry matter accumulation.

The NPK uptake of cowpea was significantly enhanced due to the efficient and well developed root system and its decomposition increased the organic matter and thus enhanced the availability of nutrients in the rhizosphere. Physiological responses due to sea weed extract spray include improved nutrient mobilization and portioning, the development of a vigorous root system, increased chlorophyll content and leaf area and senescence retardation (Metting,1990) [12]. Promotive effect of seaweed fertilizer application might be because of increased root proliferation and establishment, thereby plants were able to mine more nutrients even from distant places and deeper soil horizon in balanced proportion. The higher nutrient application might have increased nutrient content in soil solution, which reflected in terms of increased nutrient content in grain and haulm (Dekhane *et al.*, 2011) [4]. Similar results were also reported by Shivran and Ahlawat (2000) [16] and Akbari *et al*. (2005) [1]. Adequate and continuous nutrient availability through soil and foliar nutrition promotes the supply of assimilates to sink or yield container, thus enlarging the size of the yield structure. The findings of Raghuwanshi *et al*. (1993) [14], Hamayun and Chaudhary (2004)[5] are in conformity the results of present study. The combination of soil application of recommended NPKS + foliar spray of humic acid 2% recorded the second highest values for highest N, P, K uptake of cowpea was reported by Mancuso *et al*. (2006) [10], Turan and Kose (2004) [17] and Bharath *et al*. (2018) [2].

Yield

The residual effect of different nutrient management practices under both cultivation methods practiced for rice crop were influenced the yield of black gram significantly during

experimentation. The higher seed yield and bhusa yield of 1598 kg ha^{-1}and 4445 kg ha^{-1} respectively were obtained in the treatment with NPKS + 2% DAP along with Seaweed Liquid Fertilizer (T_6) which is followed by 1473 kg ha^{-1} and 3682 kg ha^{-1} respctively on foliar application of NPKS + 2% DAP along with 2% Humic acid whereas NPKS alone recorded the lowest seed yield and bhusa yield of 1031 kg ha^{-1} and 1896 kg ha^{-1} respectively.

The impact of the foliar nutrients (macro and micro) to meet the nutrient demand of the crop at the critical stage on-site availability, where they are needed without stress, would have resulted in better growth and development of the crop and ultimately the yield attributing characters and yield. The balanced growth habit, which induced more flower and fruiting body production with timely supply of nutrients through foliar spray, might have reduced shedding of flowers and fruits, which led to a positive source-sink gradient of photosynthates translocation due to growth regulator on the other hand. These favourable effects might have attributed to higher yield of cowpea under the foliar spray of nutrients and growth regulators. This finding is in line with the results of Manivannan *et al*. (2003) [11] who had recorded higher grain yield of cowpea by foliar application of microsol (NPK + micronutrients).

Table 1: Effect of foliar nutrition on dry matter production and NPK uptake of rice fallow cowpea at harvest stage

Treatments	DMP	N uptake	P uptake	K uptake
NPKS– $_1T$+ 2% DAP	30.0	52.7	12.6	69.4
*%2 + $_1T$ – $_2T$*Urea	29.3	49.7	11.5	66.4
TNAU PW + $_1T$ – $_3T$	30.1	55.3	13.0	71.5
T_4 %2 +$_1T$ – Humic acid	31.1	58.1	16.4	77.8
T_5 + $_1T$ – 2 *%*Panchagavya	31.1	56.3	14.3	73.4
T_6 + $_1T$ – 2 % *SLF*	32.0	61.1	17.5	82.4
T_7%1 +$_1T$ – PPFM	27.8	45.0	9.6	61.4
T_8P +$_1T$ – F	28.3	47.4	10.8	64.5
T_9NPKS alone –	26.0	42.6	9.2	58.2
SED	0.2	2.4	1.2	1.4
CD (0.05)	0.5	5.1	2.6	3.1

Table 2: Effect of foliar nutrient on Grain yield kg ha^{-1}, Bhusa yield kg ha^{-1}, Harvest index (%) of Rice fallow

Treatments	Grain yield	Bhusa yield	Harvest Index
NPKS – $_1T$+ 2% DAP	1339	2951	31.08
*%2 + $_1T$ – $_2T$*Urea	1273	2945	30.25
TNAU PW + $_1T$ – $_3T$	1368	3255	30.49
T_4%2 +$_1T$ – Humic acid	1473	3682	30.89
T_5 + $_1T$ – 2% anchakavya	1452	3499	30.01
T_6+ $_1T$ – 2 % *SLF*	1600	4445	31.74
T_7+$_1T$ – *%1* PPFM	1041	2185	29.57
T_8P +$_1T$ – F	1257	2765	29.32
T9 – NPKS alone	1031	1896	35.22
S Ed	290	434	3.14
CD	616	892	NS

Conclusion

The result showed that foliar application of NPKS + 2% DAP along with Seaweed Liquid Fertilizer significantly enhanced the Dry matter production and uptake of nutrient, seed yield and bhusa yield of rice fallow cowpea.

The result showed that foliar application along with recommended NPKS + 2% DAP + 2%Seaweed Liquid Fertilizer significantly enhanced the nutrient uptake and dry matter production of rice fallow cow pea compared to the rest of the treatments. Similarly the seed yield and bhusa yield of higher in above treatment. It could be concluded that among the various foliar nutrition, combination of NPKS + 2% DAP + 2% Seaweed Liquid Fertilizer for sustainable cow pea production.

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