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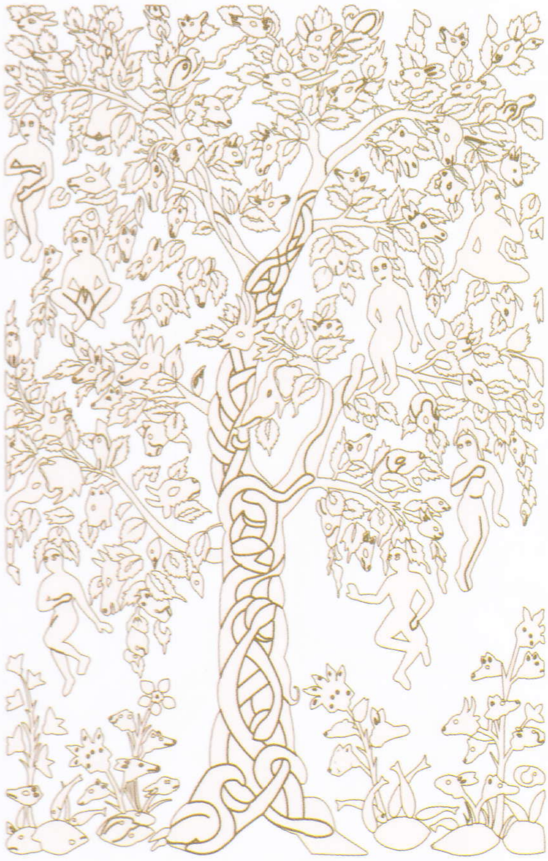

## Towards a Greener Future

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# Conference Proceedings

# Combined Usage of Organic and Inorganic Potassium on Pod Characteristics of Cowpea (*Vigna uncuigulata L.*) cv. *Waruni*

Viharnaa.S[a], Nishanthi.S[b]*, Seran.T. H[a]
[a] *Department of Crop Science, Faculty of Agriculture, Eastern University, Chenkalady, Sri Lanka,* [b] *School of Agriculture, Palamunai, Sri Lanka*

**Abstract - A field experiment was laid out in Randomized Complete Block Design with five treatments and three replications to evaluate the pod characteristics of *cowpea cvwaruni* at the Faculty of Agriculture, Eastern University of Sri Lanka. The treatments included recommended rate (75 kg/ha) of Muriate of potash (MOP) as a control (T1) and the MOP was replaced by Rice Husk Ash (RHA) at the rate of 25% (T2), 50% (T3), 75% (T4) and 100% (T5). Application of 100% RHA was 3500 kg/ha. All other agronomic practices were done according to the Department of Agriculture recommendation. Field data were collected at harvesting stage. Results revealed that application of RHA at the rate of 75% with 25% of MOP increased all the tested parameters including pod number per plant (9.23), seed number per plant (77.59), fresh weight of pods per plant (86.77 g), dry weight of pods per plant (9.41 g) and air dried weight of seeds per plant (9.33 g). Therefore, it could be concluded that application of RHA as a source of potassium at a rate of 75% with 25% of MOP is favourable for yield advancements in cowpea.**

**Keywords - cowpea, MOP, pod characteristics, RHA, waruni**

## I. Introduction

Food legumes are an alternative source of protein for the majority of the population in Sri Lanka. Cowpea is one of the old leguminous crops known to man. Its origin and domestication happened in Africa near Ethiopia and later it was developed mainly in the farms of the African Savannah [1]. Cowpea is an important legume crop in Sri Lanka. It is an inexpensive source of protein and a hardy crop well adapted to relatively dry environments [2].Cowpea's high protein content, its adaptability to different types of soil and intercropping systems, its resistance to drought, and its ability to improve soil fertility and prevent erosion makes it an important economic crop in many developing regions. Chemical based farming method, which is very popular in Sri Lanka, has had some detrimental effects on the natural environment of the country. Issues such as deterioration in soil quality, loss of biodiversity, declining arable cropping system, the quality of the products, and the concerns with human health have all been relevant to the chemical based farming method [3]; [4].

There is a need to assess various tactics focusing on the use of existing resources of plant nutrients for complementing and substituting the commercial fertilizer. As a result, numerous research efforts were made to systematically evaluate the feasibility and efficacy of organic sources, not only renovating soil fertility but also increasing crop productivity.

The combined usage of organic and inorganic fertilizers in crop production has been widely accepted as a way of increasing yield and improving productivity of the soil [5]. Rice husk is one of the most widely available agricultural by-products in many rice producing countries around the world. Globally, approximately 600 million tons of rice is produced each year. On average 20% of the rice is husk, giving an annual total production of 120 million tones? [6]. In Sri Lanka, Rice husk is highly available amendment in large quantities. It has reasonable quantities of cations such asCa, Mg, K, Na, and other essential elements including P and very little N. Rice husk Ash (RHA) from various locations contains 0.72–3.84% $K_2O$ and 0.23–1.59 MgO [7].

Potassium and phosphorous contents of RHA were 0.01-2.69% $P_2O_5$ and 0.1-2.54% $K_2O$ respectively and the pH was 8.1-11.0 [8]. The ash elevates the soil pH, thereby increasing available phosphorous, it improves the aeration in the crop root zone and also increases the water holding capacity and level of exchangeable potassium and magnesium [9].The objective of this study is therefore to evaluate the combined usage of RHA and MOP as potassium source on pod characteristics of cowpea.

## II. Materials and Methods

### Experimental Site

The experiment was conducted at the Crop Farm, Eastern University, Sri Lanka, during 2013/2014. It is located in the latitude of $7^0$ 43' N and the longitude of $81^0$ 42'. It belongs to the agro ecological region of low country dry zone ($DL_2$) in Sri Lanka. The mean annual rainfall ranges from 1400 mm to 1680 mm and temperature varies from 30 to 32 $^0$C. The major soil type of the field is sandy regosol.

**Experimental Design**

The experiment consisted of five treatments and was laid out in Randomized Complete Block Design (RCBD) with three replications. The selected rates of RHA and MOP in this experiment were five. Treatments used in the study are summarized in Table 1.

Table 1.Treatments used and their Codes.

| Treatment codes | Treatments |
|---|---|
| T1 | 100% MOP |
| T2 | 75% MOP + 25% RHA |
| T3 | 50% MOP+ 50% RHA |
| T4 | 25% MOP + 75% RHA |
| T5 | 100% RHA |

100% MOP=75 kg/ha, 60% potassium content in MOP, 100% RHA=3500 kg/ha, 1.6% potassium content in RHA:

Land was ploughed by using hand tractor and harrowed by using mammoty. Followed by plots were prepared. There were 15 plots and each plot size was 1.5m x 1.05 m and it was separated by 0.5 m border alley. After that, basal application was carried out based on the treatment combinations as mentioned in Table 1 for potassium fertilizer and Department of Agriculture recommendation were followed for urea (35 kg/ha) and triple super phosphate(100 kg/ha). Three days after basal application, cowpea (*cv.* waruni) seeds were sown at the spacing of 30 cm between rows and 15 cm between plants in all the plots. Irrigation was done except rainy days by using watering can at initial stage of seedlings thereafter by using hose pipe. Top dressing was done with 30 kg/ha of urea at onset of flowering to all the treatments and it was about one month after sowing. Crop management practices were followed based on the recommendations of Department of Agriculture.

**Measurements made**

Field data related with pods including number, fresh and dry weight, seed number per pod, air dry weight of seeds were collected in this experiment at seventy five days, after sowing.

**Statistical Analysis**

All the data were subjected to Analysis of Variance (ANOVA) and treatment means were compared using Tukey's test at 5% probability level by using Minitab 14 portable version.

## III. Results and discussion

**Number of pods per plant**

Table 2 indicates that the number of pods per plant significantly differed (p=0.014) among treatments. T4 (MOP 25%+ RHA 75%) significantly increased the pod number per plant when compared with control (T1) which treated only with 100% of MOP followed by T3, T5 and T2. T4 showed higher number of pods compared to 100% of MOP treated plants. It clearly indicates that MOP 25% with 75% of RHA had positive response on pod formation in cowpea. This may be due to the slow release of potassium from RHA compared to the MOP. The positive response of cowpea to RHA is consistent with earlier findings that ash derived from plant sources increased nutrient uptake and yield of crops such as tomato, rice and vegetables [10]; [11] and [12].

Table 2.Effect of potassium supplement on pod characteristics of cowpea*cv.* waruni.

| Treat-ments | Number of pods per plant | Number of seeds per pod | Number of seeds per plant |
|---|---|---|---|
| T1 | 7.0 ± 0.5 b | 8.0 ± 0.2 | 56.5 ± 5.3 b |
| T2 | 7.9 ± 0.3ab | 8.1 ± 0.2 | 64.9 ± 1.8ab |
| T3 | 8.4 ± 0.2ab | 8.2 ± 0.1 | 69.1 ± 3.0ab |
| T4 | 9.2 ± 0.1 a | 8.4 ± 0.2 | 77.5 ± 2.8 a |
| T5 | 8.2 ± 0.1ab | 8.2 ± 0.3 | 67.8 ± 3.0ab |
| p- value | 0.014 | 0.893 | 0.019 |

Value represents mean ± standard error of three replicates.

Mean values in a column having the dissimilar letter/letters indicate significant differences at 5% level of significance by Tukey.

**Number of seeds per pod**

There was no significant difference among the treatments on number of seeds per pod (p=0.893). The mean number of seeds per pod ranged from 8.0 to 8.4. This reveals that RHA as potassium source does not have any significant response on seeds per pod number in cowpea. Similar results were obtained by Priyatharshini and Seran [13].

**Number of seeds per plant**

Total number of seeds per plant was significantly differed among the treatments (p=0.019). T4 significantly increased the seed number per plant (77.59) followed by T3 (69.19), T5 (67.80) and T2 while control plants had lower number of seeds (56.67).The similar trend was also observed in pod number per plant among the treatments (Table 2). Yakardi*et al.* (1992) [14] reported positive response for number of pods per plant and 100 kernel weight by application of potassium.

Table 3.Effect of potassium supplement on pod characteristics of cow pea *cv.*waruni.

| Treat-ments | Fresh weight of pods per plant (g) | Dry weight of pods per plant (g) | Air dried weight of seeds per plant (g) |
|---|---|---|---|
| T1 | 52.4 ± 6.8c | 7.4 ± 0.5 b | 6.2 ± 0.4 c |
| T2 | 65.5 ± 2.5bc | 8.1± 0.4ab | 7.1 ± 0.4 bc |
| T3 | 66.7 ± 3.2bc | 8.0± 0.2ab | 7.7 ± 0.2 b |
| T4 | 86.7 ± 2.0 a | 9.4 ± 0.1 a | 9.3 ± 0.3 a |
| T5 | 69.8 ± 1.4b | 8.4 ± 0.2ab | 7.9 ± 0.0 ab |
| p- value | 0.001 | 0.041 | 0.001 |

Value represents mean ± standard error of three replicates.

Mean values in a column having the dissimilar letter/ letters indicate significant differences at 5% level of significance by Tukey.

**Fresh weight of pods per plant**

The fresh weight of pods were significantly varied (P=0.001) among the treatments as shown in Table 3. The result revealed that the weight of pods was high in T4 and low in T1. This might be due to potassium uptake of plants and thus plant growth declines rapidly with decreasing potassium release. Thisis supported by Mingfanget al. (1999) [15].

**Dry weight of pods per plant**

The summary of results pertaining to dry matter production as recorded in terms of mean dry weight of pod per plant at harvest is presented in Table 3. There were significant differences among the treatments (p=0.001). In this present investigation, plants received with 25% of MOP and 75% of RHA produced the highest dry weight while plant received with 100% MOP (T1) produced the lowest dry weight of pods per plant. This simulative effect may be due to the role of potassium on production of enzyme activity and enhanced translocation of assimilative and photosynthesis [16].

**Air dried weight of seeds per plant**

Seed weight is a key factor influences on the yield of cowpea. The effect of treatments on weight of air dried seeds per plant is given in Table 3. The result revealed that there was significant difference (P=0.01) among the treatments. Treatment with application of MOP 25% and RHA 75% (T4) showed highest seed weight and followed by the treatment with RHA 100% (T5). Significantly lower mean seed weight was found in T1 which received 100% of MOP, may be due to lower supplement of potassium. The total seed yield was also found to be increased with increasing level of RHA from 25% to 75% with decreasing level of MOP from 100% to 25%.This result is supported by Marschner (1995) [17] who reported that potassium deficiency in plants, export of photosynthate from source leaves (young and photosynthetically active leaves) to other organs decline due to a decrease in osmotic potential in the sieve tubes.

Okonet al. (2005)[18] who indicated that the optimum level of RHA plus urea can sustain rapid growth and better yield of okra even faster than commercial NPK, because rice husk ash comprises more or less all other essential plant nutrients and the presence of nitrogen will lift their uptake. This further supported by four studies. [19]; [20]; [21] and [22].

## IV. Conclusions

Rice Husk Ash as potassium supplement had significant effects on tested pod related parameters of cowpea *cv.* waruni over the control. Application of RHA at the rate of 75%with 25% of MOP increased all the tested parameters including seed weight. Therefore, it could be concluded that application of RHA as a source of potassium at a rate of 75% with 25% of MOP is favourable for yield advancements in cowpea toward greener growth in agriculture of Sri Lanka.

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