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DRY MATTER YIELD OF *Vigna unguiculata* AS AFFECTED BY APPLICATION OF *Allium cepa* PEEL EXTRACT

G.A.N. Dananjana* and T.H Seran

Department of Crop Science, Faculty of Agriculture, Eastern University, Chenkalady, Sri Lanka

Abstract

This study was carried out to maximize dry matter yield of *Vigna unguiculata* L. (cowpea) by application of *Allium cepa* peel extract. The experiment was conducted at a home garden, Mailapitiya, Kandy in May to September 2021 in a Randomized Complete Block Design. There were six treatments in six replications comprised of different percentages of *Allium cepa* peel extract expressed as, T1 was control treatment by using normal water and T2 - 20%, T3 - 40%, T4 - 60%, T5 - 80% and T6 - 100% extract concentrations. The peel extract was prepared by soaking 100 g of peels in one-liter water for 48 hours at the room temperature then extract was diluted according to the treatments. The application of *Allium cepa* peel extract was started at two weeks after seeding and the plant performance was recorded in vegetative phase and in harvesting phase. The results were confirmed that application of *Allium cepa* peel extract had significant ($P < 0.05$) effects on tested parameters over the control. The application of 40% (v/v) concentration *Allium cepa* peel extract increased the number of trifoliate leaves, root length, dry weights of stem, leaves, root and crop residue after harvesting pods. But the application of 100% (v/v) concentration of *Allium cepa* peel extract was significantly increased pod weight per plant among the treatments. The maximum mean value of dry matter yield was recorded in T6 (782.44 g/m²) and the minimum mean value was recorded in T1 (327.11 g/ m²). According to the statistically analyzed results, 100% of *Allium cepa* peel extract gave a higher dry matter yield of *Vigna unguiculata* (L) but there was no significant variation on pod weight and dry matter yield between T5 and T6. Therefore, *Allium cepa* (onion) peel at 80% could be used for increasing the pod and dry matter yield of *Vigna unguiculata* (L).

Keywords: Cowpea, foliar application, onion peel extract, pod weight

Introduction

Vigna unguiculata L. Walp. is one of the most significant grain legumes in developing countries. It is an essential crop in many impoverished regions of the globe because of its drought tolerance and fixes atmospheric nitrogen and contributes to soil fertility. Cowpea supplies food for humans and livestock. In crop cultivation, liquid fertilizer is used directly to leaves of plants. Basavaraj (2018) stated that the foliar spray technique is suitable for application of small quantities of fertilizers, particularly micronutrients. On the other hand, under certain circumstances, foliar fertilization is particularly practiced, more economic and effective when it is necessary to supply micronutrients to plants (Niewiadomska *et al.*, 2020). Mallarino (2001) noted that at early growth stages, foliar fertilization could increase P and K supplies at a time when the root system is not well developed. Onion is one of the important condiments widely used in all household. Throughout the year, onions are used in curries, as spices, salads or cooked with other vegetables (Griffiths *et al.*, 2002). Onion peel wastes are good sources of minerals such as potassium, calcium, magnesium, iron, zinc and manganese (Benítez *et al.*, 2011). Onion skins are also excellent in flavonoids, including quercetin, a powerful antioxidant and anti-inflammatory. Onion peel is a source of potassium and other nutrients. The onion peel can be used as main component for making organic liquid fertilizer. Therefore, this study was done to perform the *Allium cepa* (red onion) peel extract as liquid application on dry matter yield of *Vigna unguiculata*.

*Corresponding author: nayomidananjana123@gmail.com

Materials and Methods

This study was done at home garden in Mailapitiya, in Kandy, Central province, Sri Lanka in 2021. The climate of the experimental site receives a significant amount of rainfall throughout the year and the reddish brown lateritic soil is the foremost soil of the Kandy district. For the experiment, *Vigna unguiculata* (Cowpea) variety Dhawala seeds were used in this experiment which was designed in Randomized Complete Block Design with six treatments and six replicates. The treatments were application rates (0%, 20%, 40%, 60%, 80% and 100%) of *Allium cepa* (red onion) peel extract to plants. For extract preparation, 100 g of *Allium cepa* peels collected from kitchen waste in household level were placed in a plastic container containing one-liter water. The top lid of plastic container was covered and left at room temperature for 48 hours and then the extract was filtered (1 mm size mesh sieve) as described by Chiew *et al.* (2014). After that, it was kept separately for preparation of extract according to treatments. In this experiment polybags were filled with soil and compost and then two seeds of dhawala were planted in each polybag. After two weeks of seeding, one plant was thinned out from each bag. As basal application of fertilizer, 0.157 g urea and 0.45 g Triple superphosphate (TSP) were added while 0.135 g urea was applied as a top dressing for each polybag and other cultural practices were done according to the recommendation of the Department of Agriculture, Sri Lanka. During the experimental period, the *Allium cepa* peel extract (50 ml) was spray on each plant four times at two-week intervals. Data was collected from 3rd weeks after planting at two weeks intervals upto harvesting. Harvesting was done at 64 days after planting then plants were uprooted at 86 days. Number of trifoliolate leaves per plant, length of root (cm), dry weights of leaves, stem, root, crop residue and pods per plant were taken. The collected data was analyzed using statistical software, SAS 9.1 version. Tukey's HSD Test was used to compare the treatments at a 5% significant level were used for data analyzing.

Results and Discussion

Number of trifoliolate leaves per plant

The number of trifoliolate leaves per plant was significantly ($P < 0.05$) varied among the treatment at 9th week and treatments did not significantly influence ($P > 0.05$) in numbers of trifoliolate leaves in cowpea plants at 3rd, 5th and 7th weeks after planting. Due to the application of 40% (v/v) *Allium cepa* peel extract, the maximum mean number (8.3) of trifoliolate leaves was recorded in T3 and the minimum mean number (6.5) in control (T1) at 9th week after planting (Figure 1).

Length of root

The different concentrations of *Allium cepa* peel extract application significantly influenced ($P < 0.01$) the length of tap root. According to this result, peel extract significantly showed longest taproot in T3 (24.4 cm) among the treatments except T5 (20.9 cm) while shortest length of 14.9 cm observed in T1. Hayyawi *et al.* (2018) noted that the foliar application of tri Nano mixed fertilizer of N, P and K significantly increased plant height, root length and leaves with all treatments except the control treatment.

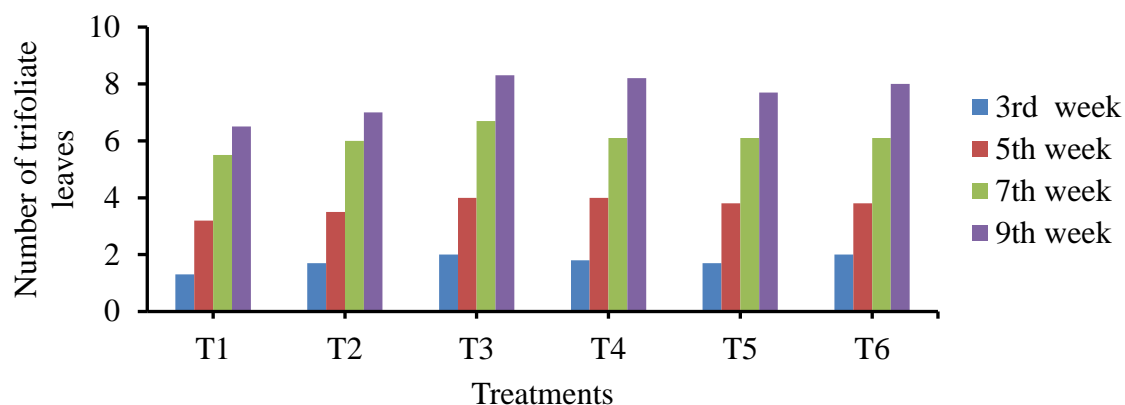


Figure 1: Effects of different concentrations of *Allium cepa* peel extract on number of trifoliolate leaves of *Vigna unguiculata* at different weeks.

Stem weight

The result showed that dry weight of stem was significantly influenced ($P < 0.05$) with the application of *Allium cepa* peel extract (Table 1). The maximum dry weight of stems was recorded in T3 (8.01 g) and the lowest dry weight of cowpea stems was recorded in T1 (4.46 g). Ebrahimian *et al.*, (2011) stated that iron foliar application significantly increased in sunflower stem dry weight and this increase can be due to increase photosynthesis and growth

Table 1: Effects of different concentrations of *Allium cepa* peel extract on dry weights of stem, leaves, roots, crop residue and pod weight of *Vigna unguiculata* plant after harvesting.

Treatments	Dry weights (g)				
	Stem	Leaves	Root	Crop residue	Mature pods
T1	4.46 ^b	2.84 ^c	0.96 ^c	8.25 ^c	6.47 ^b
T2	7.03 ^a	4.57 ^b	1.96 ^{bc}	13.56 ^b	8.68 ^b
T3	8.01 ^a	6.45 ^a	3.86 ^a	18.31 ^a	11.58 ^b
T4	6.33 ^{ab}	4.28 ^{bc}	2.26 ^b	12.87 ^b	14.82 ^b
T5	5.99 ^{ab}	3.67 ^{bc}	2.79 ^{ab}	12.44 ^b	18.43 ^{ab}
T6	6.92 ^a	3.78 ^{bc}	2.51 ^b	13.21 ^b	22.00 ^a
F test	$P < 0.05$	$P < 0.001$	$P < 0.01$	$P < 0.001$	$P < 0.001$

Mean values in a column having the dissimilar letter/letters indicate significant differences at 5% level of significance according to Tukey's HSD Test.

Leaf weight

Effect of *Allium cepa* peel extract application on dry weight of leaves is presented in Table 1. It was significantly influenced ($P < 0.001$) the dry weight of leaves among the tested treatments. The significantly maximum dry weight of leaves was observed in T3 (6.45 g) while minimum dry weight (2.84 g) of leaves was observed in the control treatment. Increased dry matter production is due to the foliar fertilization which resulted in better crop growth and photosynthetic activity which has led to better supply of photosynthates ultimately resulted in higher dry matter production of leaves per plant.

Root weight

A significant difference ($P < 0.01$) was noted on dry weight of root in cowpea plant (Table 1). Among the tested treatments, T3 (3.86 g) recorded the maximum dry weight of roots and T1

(0.96 g) was recorded the minimum dry weight of roots. Sharifi *et al.* (2018) noted that the increased dry matter production of soybean plant due to foliar application of water-soluble fertilizer and that gave significantly difference result of higher dry weight of roots among treatments than the control. In all cases, the increments in growth parameters were often highly significant in comparison with untreated ones.

Crop residue weight

There was a significant difference ($P < 0.001$) in dry weight of crop residue per plant (Table 1). Significantly highest dry weight was observed in T3 (18.31 g) while minimum weight was observed in T1 (8.25 g). This result suggested that the dry weight of crop residue of the foliar fed with 40% concentration of *Allium cepa* peel extract was increased in comparison with the control treatment.

Pod weight

Table 1 represents the different concentration of *Allium cepa* peel extract application on dry weight of mature pods per plant. All treatments significantly influenced ($P < 0.001$) the dry weight of mature pods of cowpea. Average maximum dry weight of pods was observed in T6 (22 g) followed by T5 while minimum dry weight of pod was observed in T1 (6.47 g). There was no remarkable variation ($P < 0.05$) on pod weight between T5 and T6. Thus, the application of *Allium cepa* peel extract at the rate of 100% concentration at two weeks interval increased the dry weight per pod per plant. This increase in pod weight is due to the presence of high level of potassium content in *Allium cepa* peel extract. Ramezani *et al.*, (2011) reported that potassium has the ability to improve the fruit quality by improving the formation and translocation of carbohydrates from the shoot to storage organs (pods) and carbohydrate enzymes.

Dry matter yield

Application of different rates of *Allium cepa* peel extract significantly influenced ($P < 0.01$) the dry matter yield (g/m^2) per plant which is confirmed with Tukey's HSD Test (Figure 2). Maximum dry matter yield (782.44 g/m^2) per plant was observed in T6 and minimum was observed in T1 (327.11 g/m^2). According to the analyzed results, the foliar application of *Allium cepa* peel extract at the rate of 100% concentration at two weeks interval increased the Dry matter yield when compared to control treatment. According to Rouphael *et al.*, (2020), the application of plant extracts increases the growth of different crops and can be have a positive impact of yield of plants.

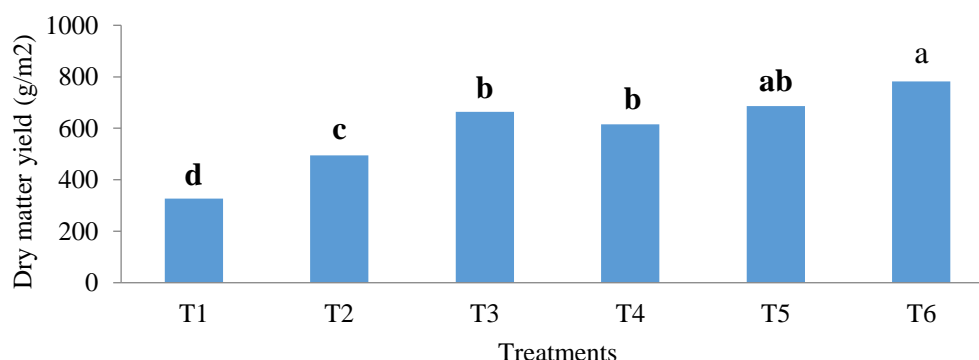


Figure 2: Effects of different concentrations of *Allium cepa* peel extract on dry matter yield *Vigna unguiculata* plant after harvest

Mean values in a bar having the dissimilar letter/letters indicate significant differences at 5% level of significance according to Tukey's HSD Test

Conclusion

The results revealed that significant variations were noted on the measured parameters due to the application of different concentration of *Allium cepa* peel extract. There was a significant difference in dry weight of the mature pods. According to statistically analyzed results, application of *Allium cepa* peel extract had a significant influence on biological yield of *Vigna unguiculata* L. Walp. The maximum mean value of dry matter yield was recorded in T6 and the minimum mean value of dry matter yield was recorded in T1. There was no remarkable variation ($P < 0.05$) on dry matter yield between T5 and T6. Therefore, 80% (v/v) of *Allium cepa* peel extract could be applied to increase dry matter yield of *Vigna unguiculata*.

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