STUDY ON BLACK GRAM (*Vignamungo*)/ VEGETABLE AMARANTHUS (*Amaranthustricolor* L.) INTERCROPPING IN SANDY REGOSOL

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ABSTRACT: Intercropping is the practice of growing more than one crop in the same field simultaneously and considered for increasing and stability of yield per unit. In this regard, a field experiment was conducted at Crop farm, Eastern University, Sri Lanka during yala 2014 to study the effect of black gram/vegetable amaranthus intercropping system in sandy regosol. The experiment was laid out in Randomized Complete Block Design with four replicates and five treatments; monocropping black gram (T1), monocropping vegetable amaranthus (T2), black gram intercropped with one row of vegetable amaranthus (T3), black gram intercropped with two rows of vegetable amaranthus (T4) and black gram intercropped with three rows of vegetable amaranthus (T5). All the agronomic practices for cultivation were done according to the department of agriculture, Sri Lanka recommendation. The measurements were recorded at the harvesting stage of vegetable amaranthus and harvesting stage of black gram at thirty and sixty days after sowing of crops, respectively. The results showed that black gram/vegetable amaranthus intercropping system had significant ($p<0.05$) influenced on tested parametersof vegetable amaranthus such as fresh leaf weight, fresh stem weight along with marketable yield.In which highest marketable yield was recorded in monocroppingamaranthus followed by T3 and T4 and lowest in T5. In the meantime there were significant differences on tested parameters including plant height and total plant fresh weight of black gram compare to monocropping while yield per hectare of black gram did not change significantly by intercropped vegetable amaranthus ($p<0.05$). Therefore it can be concluded that vegetable amaranthus and black gram are compatible crops and can be recommended for intercropping in sandy regosol.

Keywords: Black gram, Intercropping, Marketable yield, Sandy regosol,Vegetable amaranthus,

1. INTRODUCTION

Intercropping is the practice of growing more than one crop in the same field simultaneously. It is one of the many farming systems that hold great potential to solve future food and economic problems in developing countries (Tsubo*et al*., 2001). By intercropping, dependence on one crop is avoided and also different varieties of products can be produced throughout the year. The essential features of intercropping systems are that they exhibit intensification in space and time, competition between and among the system components for light, water and nutrients and the proper management of these interactions (Oseni, 2010). Presently, interest in intercropping is increasing and fast becoming important among the small scale farmers because of their diversified needs and low farm income from the mono-cropping system (Oseni, 2010).

Intercropping between legumes and other suitable crops is an alternative system for small-scale farmers to improve income and food production per unit area, and lessen the risks of total crop failure due to environmental limitations (Prasad and Brook, 2005). Black gram is one of the important grain legumes in the rain fed farming system in dry and intermediate zones of Sri Lanka. It can be grown under low moisture and fertility conditions. It has high nutritive value and consist high content of

proteins, vitamins and minerals (DOA, 2015). It is an important protein source for people in the cereal-based society. Legumes adapt well to various cropping systems owing to their ability to fix atmospheric nitrogen (N_2) in symbiosis with soil bacteria of Rhizobium spp. In intercropping system, component crops should be able to complement each other and obtain better overall use of resources than grown separately. Nitrogen is critical for vegetable amaranthus cultivation. Vegetable amaranthus is one of the most nutritious plants, both in raw and cooked form in the world (Anon, 2015). Botanists and nutritionists have studied this plant and found out that it has great nutritional value, especially high in protein, calcium, folic acid and vitamin C (Anon, 2015). The nutritional value of this crop is comparable to spinach, but much higher than cabbage and Chinese cabbage (Ebert *et al*., 2011). Vegetable amaranthus is increasingly gaining importance both for household consumption and commercial production in Africa and Asia. There is a good market potential for this crop, both in the high-price and low-price (Ebert *et al*., 2011). Therefore, this experiment was planned to study the effect of black Gram/ vegetable amaranthus intercropping in sandy regosol.

2. METHODOLOGY

2.1. Experimental Site and Experimental Design

The experiment was conducted at the Crop Farm, Faculty of Agriculture, Eastern University of Sri Lanka during yala2014. It is 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 ^{0}C to 32 ^{0}C. The soil type is sandy regosol. Experiment was laid out in a Randomized Complete Block Design (RCBD) with four replications. Experiment consisted of five treatments;

T1- Monocropping black gram
T2- Monocroppingvegetable amaranthus
T3- Black gram + one row of vegetable amaranthus
T4- Black gram + two rows of vegetable amaranthus
T5- Black gram + threerows of vegetable amaranthus

2.2. Land Preparation and Planting

Initially, land was ploughed by using two wheel tractor and harrowed well by using mammoty followed by application of cow dung at the rate of 10 ton/ha to each plot and incorporated into the soil. Then, Urea-35 kg/ ha, TSP- 100 kg/ha and MOP- 75 kg/ha were applied as basal fertilizer. There were 20 plots of 1.5 m × 1 m and these were separated by 0.5 m and the blocks were separated with the space of 1 m. Two days after basal application, the seeds of component crops were sown where 30 cm × 10 cm used for mono cropping black gram and 10 cm × 5 cm used for mono cropping vegetable amaranthus. When vegetable amaranthusintercropped with black gram, the spacing between plants were kept as 5 cm in the meantime the spacing between rows was determined based on the treatments such as 15 cm (T3), 10 cm (T4), and 7.5 cm(T5) respectively. The recommendations of the Department of Agriculture, Sri Lanka were used for other crop management practices including irrigation, fertilizer application and crop protection measures.

2.3. Measurements

Plant height, leaf area, main root length, fresh weights of leaf, stem and rootand marketable yield were recorded from vegetable amaranthus while plant height, leaf area, fresh weights of total plant, leaf, stem and root and yield were recorded from black gram at thirty and sixty days after sowing (DAS) of crops, respectively.

3. RESULTS AND DISCUSSIONS

3.1. Effect of black gram/vegetable amaranthus intercropping on performances of amaranthus

As can be seen from table 1 the effect of black gram/ vegetable amaranthus intercropping had significant ($p<0.05$) effect on tested parameters such as fresh weight of leaf and fresh weight of stem and marketable yield of vegetableamaranthus while there were no significant differences on plant height, leaf area, main root length and fresh weight of root (Fig. 1). The maximum marketable yield was achieved in mono cropping of vegetable amaranthus. However, black gram with one row of amaranthus provided comparable marketable yield with mono cropping amaranthus at 5% of significant level.

Table 1. Effect of black gram/ vegetable amaranthus intercropping in sandy regosol at thirty days after sowing on vegetable amaranthus

Treatments	Fresh leaf weight (g)	Fresh stem weight (g)	Marketable yield (tons/ha)
T2	10.52 a	11.02 a	21.25 a
T3	10.35 a	07.31 b	20.35 a
T4	06.38 b	05.97 b	18.61 ab
T5	04.57 b	06.82 b	14.82 b
F-test	*	*	*

Value represents mean of four replicates. * Represents significant at 5% level of probability and ns represents not significant. Mean values in a column having dissimilar letter/letters indicate significant differences at 5% level by DMRT.

Banik (2000) stated that, competition among intercropping mixture is thought to be the major aspect affecting yield as compared cropping of each crop. This might be the reason for significant yield reduction in vegetable amranthus in T4 and T5 compare to mono cropping vegetable amaranthus. Further, present findings were coinciding with the studies of Adigbo (2009) who reported that amaranthus is a compatible crop for intercropping system. This also supported by Aynehband and Behrooz (2011).

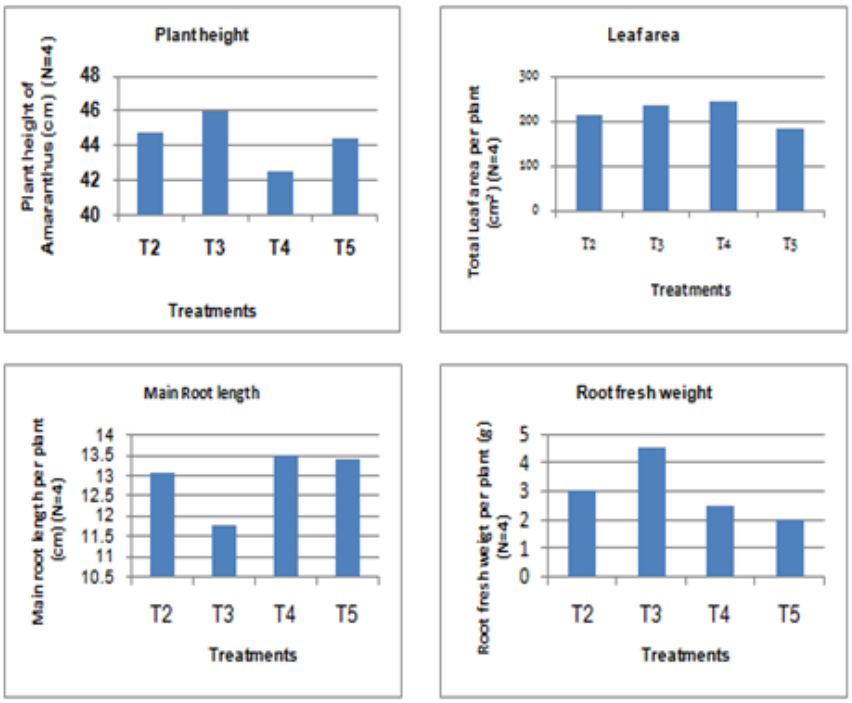

Figure 1.Effect of back gram/ vegetable amaranthus intercropping in sandy regosol on growth of vegetable amaranthus at thirty days after sowing

3.2. Effect of black gram/ vegetable amaranthus intercropping on performances of black gram

Growth parameters such as plant height and total fresh weight of plant were significantly differed among the treatments at 5% significant level (Table 2) while, there was no significant differences observed among tested parameters such as root length, leaf area, fresh weight of leaf, fresh weight of root, fresh weight of stem and yield when black gram was intercropped with vegetable amaranthus at 5% of significant level (Fig.2).

Table 2.Effect of black gram/ vegetable amaranthus intercropping in sandy regosol at sixty days after sowing on black gram.

Treatment	Plant height (cm)	Total plant fresh weight(g)	Yield (tons/ha)
T1	22.35 b	27.35a	2.21
T3	42.69 ab	21.08b	2.16
T4	37.50 ab	18.95c	2.13
T5	52.19 a	19.38bc	2.09
F-test	*	*	ns

Value represents mean of four replicates. * Represents significant at 5% level of probability and ns represents not significant. Mean values in a column having dissimilar letter/letters indicate significant differences at 5% level by DMRT.

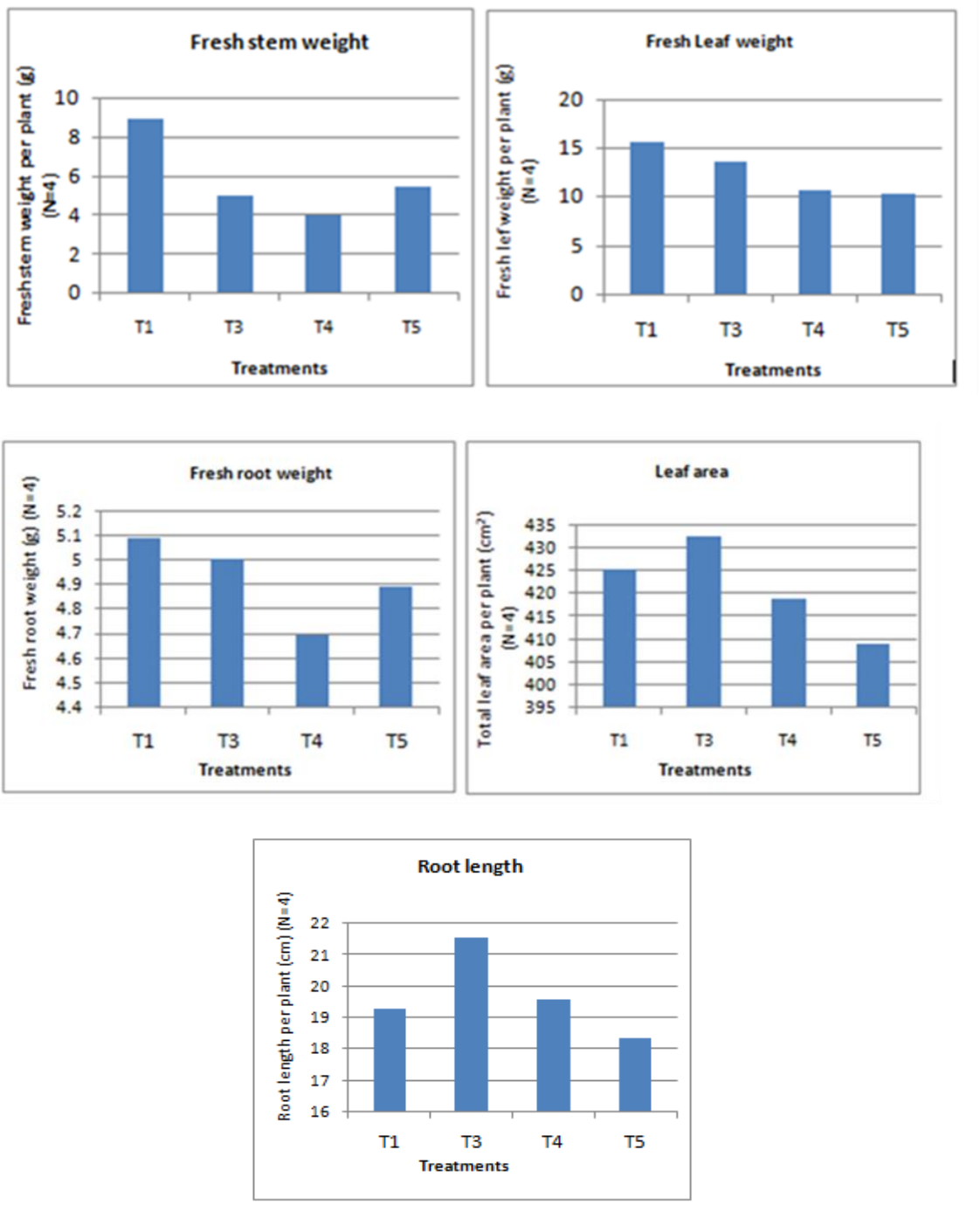

Figure 2. Effect of back gram/ vegetable amaranthus intercropping in sandy regosol on growth of black gram at sixty days after sowing.

Fresh weight of black gram was significantly differed ($p<0.05$) among tested treatments. Average fresh weight of black gram ranged from 19.38 g in T5 to 27.35 g in T1. Highest fresh weight of black gram was recorded in T1 where, no vegetable amaranthus planted. This might be explained as lower competition for

resources when no more intercrops, leading to produce more fresh weight of black gram as base crop.

There was no significant ($p<0.05$) effect on black gram yield by intercropping patterns. Black gram yield (2.21) was high in monocropping as compared that of intercropping. Average yield range from 2.09 to 2.21 (tons/ha). This yield data suggests that intercropping of vegetable amaranthus with black gram did not affect the yield of black gram. Harvesting of vegetable amaranthus at 30 DAS of black gramfrom the experimental plot might be improved the growth of black gram at latter part of their life cycle.

Further, in this experiment where the vegetable amaranthus was sown at one row, no significant difference in yield was found while vegetable amaranthus was sown more than one row, the yield from black gram was slightly lower by the end of the growing season due to competitive exclusion by the amaranthus plant on vegetative phase of black gram. These results were supported by Hauggaard-Nielsen *et al*. (2004) who stated that high plant density can reduce yield due to competitive exclusion of component crops.

4. CONCLUSIONS

Findings of the experiment showed that black gram yield did not change significantly by intercropping with vegetable amaranthus. Further, marketable yield of vegetable amaranthus from black gram with intercropping of one row of amaranthus and mono cropping amaranthus were comparable. Therefore it can be concluded that black gram and vegetable amaranthus are compatible crops and can be recommended for intercropping in sandy regosol.

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