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EVALUATION OF GROWTH ATTRIBUTES AND YIELD OF MAIZE + PULSE INTERCROPPING SYSTEM

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Abstract

Field investigation was conducted during *Kharif* season (June to Sep, 2018) to explore the Maize – pulse intercropping system. The experiment was laid out in Randomized Block Design consists of five treatments, T_1 - Maize alone, T_2 - Maize + Black gram, T_3 - Maize + Green gram, T_4 - Maize + Cowpea, T_5 - Maize + Soybean with four replication. The plot size was 5.4m×4m and seeds of varieties Maize "Co-1" was sown with a spacing of 60×20 cm were tested, with duration 105 days. The intercrop, Black gram "ADT-3", Green gram "ADT-3" were sown with a spacing of 30×10 cm and Cowpea "Co-6", Soybean "Co-1" were sown with a spacing of 30×15 cm were tested. The growth attributes and yield of maize *viz*., Plant height, leaf area index, dry matter production, grain yield were favourably influence by the treatments. The treatment T_1 – Maize alone recorded the higher plant height, leaf area index, dry matter production, grain yield. It was followed by Maize + Black gram (T_2). The T_2 (Maize + Black gram) treatment significantly recorded the highest Total Maize Equivalent Yield.

Key words : Maize, Intercropping, LAI, DMP, and TMEY.

Introduction

Maize (*Zea mays* L.) is the third most important cereal crop next to the wheat and rice in the world. Maize production is high compared to any other cereal crops and its adaptability has been wide range to the environments. The crop has very high genetic yield potential, and hence it is also called as the "Queen of cereals". The maize crops can be used as consume purpose for human being, feed for the poultry, cattle, sheep, and production of lactic acid, alcohol for the industries. It is a resourceful, to convert the solar energy into dry matter accumulation. In the Indian economy, the maize occupies an important place as like the rice, wheat and millets.

Maize is a tall growing and wide spaced crop, its provides sufficient inter row space, which can be profitably utilized for raising short duration and short statured remunerative crops by providing sustainable yield and income to the farmers. Intercropping is one of the potential cropping systems to exploit resources like light, moisture and nutrients more efficiently than a mono cropping. Intercropping is the systems to cultivate the two or more crops on the same piece of land within the same year and it can be used to promote their interaction of the crops moreover its avoid the dependence of one crop and increase the crop productivity. Also that, intercropping systems is more effectively used for the growth factors, since they capture the more solar radiation and its make useful for the water and nutrients available sources, reduce the pests and diseases prevalence and suppress the weeds growth and also its favourable for the soil-physical conditions, predominantly the intercropping of cereals and legume crops are also sustain and recover the soil fertility is reported by Sheoran *et al.,* 2010. It is imperative to raise the productivity by vertically with minimum cost of cultivation and by suitable them in multiple, mixed and intercropping system to meet the growing demand of the increasing population. Intercropping is one of the most important technique of crop production, since it efficient utilization of available natural resources *viz.,* water, nutrients and solar energy. It also has several advantages such as increase in yield,

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which includes greater stability of production, minimum risk for crop failure with greater diversity of food and income sources. Moreover, main crop yields can be reduced by intercropping techniques, both as a result of loss of land to the legume, and also to competition for growth resources.

Cropping system involving legumes, oilseeds and cereals together in the same field offers the possibility of yield advantages for both component crops (Ogutu *et al.,* 2012). Growing of legumes like blackgram, greengram, cowpea and soybean that constituted as potential intercrops, that ensured more efficient use of land, greater yield stability, diversity of produce and market opportunities (Matusso *et al.,* 2012).The intercropping system offer a means of promoting diversity of diet, stability of production reduced pests incidence, efficient use of labour, intensification of production with limited source and also maximization of returns (Faroda *et al.,* 2007). Hence the lack of such information necessitates studies on maize based intercropping which may ensure sustained crop productivity and land use.

Materials and Methods

The experiment was conducted in Randomized Block Design consists of five treatments, T_1 - Maize alone, T_2 - Maize + black gram, T_3 - Maize + green gram, T_4 - Maize + cowpea, T_5 - Maize + soybean with four replication. The plot size was 5.4m×4m and seeds of Maize variety "Co-1" were sown with a spacing of 60×20 cm. The intercrop, black gram and Green gram "ADT-3" were sown with a spacing of 30×10 cm and Cowpea "Co-6", Soybean "Co-1" were sown with a spacing of 30×15 cm. The observations of plant height, LAI, DMP and grain yield were recorded. The collected data was statistically analyzed. Recommended fertilizer dose of 135:62.5: 50 kg ha^{-1} of N, P_2O_5 and K_2O was applied to the main crop of maize and 25:50: 25 kg ha^{-1} of N, P_2O_5 and K_2O was applied to the pulse intercrop plot. Half of the recommended nitrogen, entire dose of phosphorus and half dose of potassium were applied as basal after sowing. The remaining half dose of nitrogen and potassium were applied in two equal splits at 35 and 45 DAS.

Results and Discussion

Growth attributes (Table 1)

The treatments exert significant influence on Plant height, DMP on 60 DAS and at harvest stage and LAI on 60 DAS.

Plant height

Adaptation of different intercropping practices depicted distinct variations on the height of plants at 60 DAS and at harvest stage. Among the treatments, Maize alone (T_1) is recorded highest plant height of 145.41, 161.79 cm at 60 DAS and at harvest stage, respectively. It was onpar with Maize + Black gram (T_2) that recorded with plant height of 139.16, 157.23 cm at 60 DAS and at harvest stage, respectively. This might be due to rapid nutrient availability and supply to the crop at early stage of crop growth which increase the plant height. Similar findings were reported by Priya Dharshini *et al.,* (2019). The Maize + Soybean (T_5) were recorded with least plant height of 110.12, 124.05 cm at 60 DAS and at harvest stage, respectively.

Dry matter production (DMP)

Different intercropping practices depicted distinct variations on the DMP of plants at 60 DAS and at harvest stage. Among the treatments, Maize alone (T_1) is recorded highest DMP of 3536, 5783 kg ha^{-1} at 60 DAS and at harvest stage, respectively. It was onpar with Maize + black gram (T_2) that recorded with DMP of 3487, 5672 kg ha^{-1} at 60 DAS and at harvest stage, respectively. Higher DMP could be increased the leaf area index by adequate nutrient supply, which also increased photosynthetic assimilates in plant which finally paved way for increasing dry matter accumulation. Similar findings were reported by Samuel sangtam *et al.,* (2019).

Table 1: Influence of different intercropping practices on growth attributes and yield of maize.

Treatments	Plant height (cm)		DMP at harvest (kg ha^{-1})		LAI 60 DAS	Grain yield (kg ha^{-1})	TMEY (kg ha^{-1})
	60 DAS	at harvest	60 DAS	at harvest			
T_1 - Maize alone	145.41	161.79	3536	5783	5.34	2481	2481
T_2 - Maize + Black gram	139.16	157.23	3487	5672	5.21	2411	3394
T_3 - Maize + Green gram	130.70	143.97	3289	5306	4.85	2223	3132
T_4 - Maize + Cowpea	123.72	139.01	3271	5267	4.66	2199	2666
T_5 - Maize + Soyabean	110.12	124.05	3073	4804	4.28	2031	2249
S.Ed	3.73	5.18	87	163.1	0.15	72.4	122.6
CD ($_P$ = 0.05)	8.09	11.24	188	354	0.32	157	267

The Maize + soybean (T_5) were recorded with least DMP of 3073, 4804 kg ha^{-1} at 60 DAS and at harvest stage, respectively.

Leaf Area Index (LAI)

Intercropping practices were showed distinct variations on the LAI of plants at 60 DAS. Among the treatments, Maize alone (T_1) is recorded highest LAI of 5.34 at 60 DAS. It was onpar with Maize + black gram (T_2) that recorded with LAI of 5.21 at 60 DAS. Application of nutrients to the crop, there by increased the growth attributes of maize *viz.,* plant height, no of leaves, leaf length and width leads to higher LAI. Similar findings were reported by Manpreet *et al.,* (2016). The Maize + soybean (T_5) were recorded with least LAI of 4.28 at 60 DAS.

Grain yield (Table 1)

Result of the study revealed that all the intercropping treatments have a significant effect on yield of maize. The treatments, Maize alone (T_1) is recorded highest grain yield 2481 kg ha^{-1}. It was on par with Maize + black gram (T_2) that recorded with highest grain yield 2411 kg ha^{-1}. An adequate supply of nutrient in the soil, plant maintain their chlorophyll content for long time, which resulted in slower leaf senescence and moreover, plant was able to supply nutrient and photo assimilates for a longer period which resulted in increased grain yield. Similar findings were reported by Ishaq Rahimi *et al.,* (2019). The Maize + soybean (T_5) were recorded with least grain yield 2031 kg ha^{-1}.

Total maize equivalent yield (TMEY) (Table 1)

Adaptation of different intercropping practices marked distinct variations on the TMEY of the maize and pulse crops. Among the treatments, Maize + black gram (T_2) is recorded highest TMEY of 3394 kg ha^{-1}. It was onpar with Maize + green gram (T_3) that recorded with TMEY of 3132 kg ha^{-1}. This might be due to black gram yield potential, price of pulses and efficient utilization of resources with respect to time and space might be the higher TMEY. Similar findings were reported by Padhi and Panigrahi 2006. The Maize + soybean (T_5) were recorded with least TMEY of 2249 kg ha^{-1}.

Conclusions

Based on the above results, it may be concluded that when compare to sole cropping of maize, intercropping of black gram in maize on Total Maize Equivalent Yield can be the most viable and remunerative technology to get higher income without deteriorating soil health and environmental quality. The Maize + black gram found to be the most efficient, cost effective and addition income to the farmer's.

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