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INTERCROPPING GARDENPEA (*Pisium sativum*) WITH MAIZE (*Zea mays*) AT FARMERS' FIELD

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Abstract

An experiment was conducted at the farmers' field of Phulpur MLT site of On-Farm Research Division, Bangladesh Agricultural Research Institute (BARI), Mymensingh during 2015-16 and 2016-17 to find out a suitable intercrop combination of garden pea with maize for higher productivity and profitability. Five treatments, viz. T_1= Maize (100%) + one row garden pea (33%) in between maize lines, T_2= Maize (100%) + two row garden pea (66%) in between maize lines, T_3= Maize (100%) + garden pea broadcast (100%) in between maize lines, T_4= Sole maize and T_5= Sole garden pea were tested following RCB design with six dispersed replications. Maize var. BARI Hybrid Maize-9 and garden pea var. BARI Motorshuti-3 were used in monoculture as well as in intercropping situations. Intercropping of garden pea improved the yield components of maize and offered some additional yield. The highest maize grain yield (8.62 t ha^{-1}) and maize equivalent yield (20.22 t ha^{-1} yr^{-1}) were recorded with maize (100 %) + two rows of garden pea (66 %) in between maize lines (T_2). The values of all the competition functions were greater than unity and maize (100 %)+ two rows of garden pea (66 %) in between maize lines (T_2) showed higher values of land equivalent ratio (1.56), gross return (Tk. 311920 ha^{-1}), gross margin (Tk. 175697 ha^{-1}) and BCR (2.29) as compared to other treatments.

Keywords: Maize, gardenpea, intercropping, land equvalent ratio, benfit-cost

Introduction

Bangladesh is an agricultural country and about 14.22 % of the gross domestic product (GDP) comes from agriculture (BBS, 2017). But the cultivable land area is decreasing with the increase in population and subsequent urbanization and industrialization in Bangladesh. Increasing food demand for additional population is creating challenge to the country for increasing productivity of the limited land. Intercropping system is one of the most common practice used more than one crop together in sustainable agricultural system to increase the productivity and stability of yield in order to improve resource utilization and environmental factors (Alizadeh *et al.*, 2010). The main concept of intercropping is to get increased total productivity per unit area and time, besides equitable and judicious utilization of land resource. Intercropping brings an increase in

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production or yield benefits, more efficient use of water, land, nutrients and labors reduction in problems caused by pests, diseases and weeds (Awal *et al*., 2006).

Maize is ranked third after rice and wheat among the most important cereal crops in Bangladesh. Maize is normally grown in wider row spacing (60 cm) and inter row space can profitably be utilized for higher returns. So, farmers can easily grow a short duration crop as intercrop with maize at early growth stage. Garden pea is an important legume crop as well as a primary source of plant protein for human and animals. Garden pea is a short duration (60-70 days), high value *rabi* crop suitable for the farmers' to earn quick return as well as cropping intensity will be increased without hampering the growth and yield of maize.

Hybrid maize covers a vast area of Mymensingh district as a single crop in *rabi* season. Moreover, garden pea as a leguminous crop, incorporation of green biomass of garden pea into soil after harvest of pods may increase soil fertility and soil organic matter. Legume in an intercropping system not only provides nitrogen to the associated crops but also increase the amount of humus in the soil due to decaying crop remains. Legumes as intercrop with maize instead of showing any adverse effect on maize increase its yield (Singh and Bajpai, 1991 and Mucheru *et al*., 2010). Better intercrop production could be achieved with the choice of appropriate crops, population density and planting geometry of component crops (Santalla *et al*., 2001). In this context, the experiment was undertaken to find out the suitable intercrop combination of garden pea with maize for increasing total productivity and profitability.

Materials and Methods

The experiment was conducted at the farmers' field of Phulpur MLT site, On-Farm Research Division, Bangladesh Agricultural Research Institute (BARI), Mymensingh during 2015-16 and 2016-17. The experimental site was situated at approximately $24^0 38^/$N and $90^0 16^/$E with the altitude of 19 m above sea level. Mean annual precipitation was 2212 mm, most of which (90 %) was received during May to September due to monsoon. The soil was typical Dark Grey Floodplain with sandy loam to silty loam in texture of the medium highland having pH 6.2 to 6.5 under the Agro-ecological Zone-9 (AEZ-9). The experiment consisted of five treatments, *viz*. T_1= Maize (100%) + one row garden pea (33%) in between maize lines, T_2= Maize (100%) + two row garden pea (66%) in between maize lines, T_3= Maize (100%) + garden pea broadcast (100%) in between maize lines, T_4= Sole maize and T_5= Sole garden pea. The maize var. BARI Hybrid Maize-9 and garden pea var. BARI Motorshuti-3 were used in the experiment. The experiment was laid out in randomized complete block design with six dispersed replications. The unit plot size was 8.0 m × 5.0 m. Maize was the main crop and garden pea was grown as intercrop in the study. Garden pea was intercropped in between maize row @ 33, 66 and 100% plant population. Maize seeds were sown at 60 cm × 20 cm spacing both in sole and intercrop situation. Except broadcasting, garden pea seeds were sown maintaining 25 cm row to row and 12 cm plant to plant spacing both in sole and intercrop. The crops maize and garden pea were sown on 20 November, 2015 and 12 November, 2016. The recommended doses of fertilizers such as, 250-55-120-50-5-1 kg NPKSZnB ha^{-1} and 45-30-45 kg NPK ha^{-1} for sole crop of maize and garden pea, respectively were applied separately in sole crop. In intercropping maize was fertilized with 250-55-120-50-5-1 kg NPKSZnB ha^{-1} in the form of urea, triple super phosphate, muriate of potash, gypsum, zinc sulphate and boric acid, respectively. One third of N and all other fertilizers were applied as basal during final land preparation by broadcasting method. Remaining two-third of N was split equally and applied at 8-10 leaves stage after harvesting of garden pea and tasseling stage beside maize rows. Mulching and hand weeding were done as and when required to keep the field reasonable weed free. Drasban was sprayed at 15-20 days intervals as precautionary measure against insects attack. Garden pea was harvested on 23 January 2016 and 15 January 2017 and maize was also harvested on 17 April 2016 and 05 April 2017, respectively. The yield contributing characters of garden pea and maize were recorded from 10 randomly selected plants in both the years. Harvest index (HI) was calculated as per following equation:

$$\text{HI (\%)} = \frac{\text{Economic yield}}{\text{Biological yield}} \times 100$$

Yield of individual crop was converted into equivalent yield on the basis of the prevailing market price of individual crop (Prasad and Srivastava, 1991).

$$\text{Maize equivalent yield (MEY)} = \text{Yim} + \frac{\text{Yig} \times \text{Pg}}{\text{Pm}}, \text{ and}$$

$$\text{Garden pea equivalent yield (GEY)} = \text{Yig} + \frac{\text{Yim} \times \text{Pm}}{\text{Pg}}$$

Where, Yim= Yield of intercrop maize, Pg= Price of garden pea, Pm= Price of maize and Yig= Yield of intercrop garden pea

Various competition functions viz., land equivalent ratio (LER), area time equivalent ratio (ATER), system productivity index (SPI), replacement value of intercropping (RVI), monetary advantage index (MAI), aggressivity index (A), competitive ratio (CR) and relative crowding coefficient (RCC) were worked out by using following formula to find out the benefit of intercropping and the effect of competition between the treatments used in this experiment.

ATER= $\left[\frac{\text{Yim}}{\text{Ysm}} \times \text{Tm} + \frac{\text{Yig}}{\text{Ysg}} \times \text{Tg}\right] \div \text{T}$, Where Y_{im}= Yield of maize in intercropping, Y_{sm}=yield of maize in sole cropping, Y_{ig}= yield of garden pea in intercropping, Y_{sg}= yield of garden pea in sole cropping, T_m= Duration of maize, T_g= Duration of garden pea and T= Total duration of intercropping system.

RVI $= \dfrac{\mathrm{Yim} \times \mathrm{Pm} + \mathrm{Yig} \times \mathrm{Pg}}{\mathrm{Ysm} \times \mathrm{Pm} - \mathrm{Csm}}$ Where Y_{im} & Y_{ig} are the yield of intercrops, P_m & P_g are the respective market price of these crops, Y_{sm} & C_{sm} are the yield and input cost of the main crop in sole stand.

$$\mathrm{MAI} = \frac{\text{Monetary value of combined intercrops yield}}{\mathrm{LER}} \times (\mathrm{LER} - 1)$$

Relative crowding coefficient (RCC): RCC_{maize} ×, $RCC_{garden\ pea,}$

Where, $\mathrm{RCC}_{maize} = \dfrac{\mathrm{Yim} \times \mathrm{Zgi}}{(\mathrm{Ysm} - \mathrm{Yim}) \times \mathrm{Zmp}}$, and

$\mathrm{RCC}_{garden\ pea} = \dfrac{\mathrm{Yig} \times \mathrm{Zmp}}{(\mathrm{Ysg} - \mathrm{Yig}) \times \mathrm{Zgp}}$ where Z_{mp} and Z_{gp} are the proportion of maize and garden pea in the mixture, respectively.

Aggressivity (A) index:

$$A_{maize} = \frac{\mathrm{Yim}}{\mathrm{Ysm} \times \mathrm{Zmp}} - \frac{\mathrm{Yig}}{\mathrm{Ysg} \times \mathrm{Zgp}} \text{ and } A_{gardenpea} = \frac{\mathrm{Yig}}{\mathrm{Ysg} \times \mathrm{Zgp}} - \frac{\mathrm{Yim}}{\mathrm{Ysm} \times \mathrm{Zmp}}.$$

Competitive Ratio (CR):

$$\mathrm{CR}_{maize} = \frac{\mathrm{LER}_{maize}}{\mathrm{LER}_{garden\ pea}} \times \frac{\mathrm{Zgp}}{\mathrm{Zmp}} \text{ and } \mathrm{CR}_{garden\ pea} = \frac{\mathrm{LER}_{garden\ pea}}{\mathrm{LER}_{maize}} \times \frac{\mathrm{Zmp}}{\mathrm{Zgp}}$$

SPI= $\dfrac{\mathrm{Ysm}}{\mathrm{Ysg}} \times \mathrm{Yig} + \mathrm{Yim}$, Where Ysm and Ysg= Mean yield of maize and garden pea in sole cropping, Yim and Yig= Mean yield of maize and garden pea in intercropping.

Data on yield and yield contributing characters were collected properly. Data were statistically analyzed using analysis of variance technique with the help of computer package MSTAT-C and mean comparison among the treatments were made by Least Significant Difference (LSD) test at 5% level of significance (Gomez and Gomez, 1984). Pooled analysis was done as because there was no significant variation in yield and yield parameters between the years. Finally, benefit cost ratio was calculated based on prevailing local market price.

Results and Discussion

Yield attributes of maize

Number of grains cob^{-1} and grain yield of maize were significantly influenced by maize+garden pea intercropping systems (Table 1). The number of cobs plant^{-1} was not influenced significantly and similar trend was followed in case of plant height. There was trend to increase grains cob^{-1} in intercropping situation than sloe crop. Increased number of grains cob^{-1} of maize was also reported in maize-soybean intercropping system by Zhang and Li (1987) and Rana *et al*. (2001). Thousand grains weight of maize was not significantly influenced due to intercropping but there was an increasing trend when garden pea was intercropped with maize. Increased thousand grains weight was also noticed by Zhang and Li (1987) when maize was intercropped with leguminous crop like soybean. Singh *et al*. (2000) also reported that inclusion of legumes as intercrops increased the yield attributes viz., number of cobs plant^{-1}, grains cob^{-1} and thousand grains weight of maize.

Grain yield of maize

Grain yield of maize was influenced when intercropped with garden pea. Maize gained yield advantage of 1.83 to 5.12 % due to legume association as compared to sole maize (Table 1). The highest maize grain yield (8.62 tha^{-1}) was recorded when maize (100 %) + two rows of garden pea (66 %) intercropped in between maize lines (T_2) with 5.12 % increment in yield as compared to sole maize. The yield advantage of maize in intercropping systems might be resulted from maize-legume association due to symbiotic nitrogen fixation by garden pea and current transfer of nitrogen to the associated maize plants. This result corroborates with the findings of Rana *et al.* (2001) who reported that grain yield of maize was increased 2.32 to 7.50 % over sole cropping when it was intercropped with grain legumes (soybean, urdbean and cowpea). Kheroar and Patra (2013) also reported that the highest maize grain yield was recorded with maize + green gram intercropping system. The harvest index (HI) of maize did not differ by the intercropping systems. The harvest index of maize had higher value in $T_3>T_2>T_1>T_4$.

Yield and yield attributes of garden pea

Yield and yield contributing characters of garden pea were significantly influenced by maize+garden pea intercropping systems (Table 2). All the intercrops grown with maize were shorter in height than sole crop. Garden pea in association with maize decreased 25.89 to 31.33 % pods plant^{-1} and 3.94 to 12.11 % seeds pod^{-1}. Sole garden pea (T_5) produced higher number of pods (16.34) plant^{-1} as well as seeds (3.55) pod^{-1}. Significant differences in thousand seeds weight and harvest index were noticed. The entire intercrops garden pea was recorded lower 1000-seeds weight than sole crop. The higher pod yield (6.45 tha^{-}

[1]) was produced in sole garden pea (T_5) which was statistically different with intercrops yield due to cumulative effect of yield attributes. Lower yield was obtained from all the intercrops than sole crop might be due to lower plant population and yield attributes.

Table1. Yield attributes, grain yield and harvest index of maize as influenced by different intercropping systems at Mymensingh during 2015-16 and 2016-17 (pooled)

Treatment	Plant height (cm)	Cob plant^{-1} (no.)	Grains cob^{-1} (no.)	1000-grains weight (g)	Grain yield (t ha^{-1})	Harvest index (%)
T_1	202.11	1.43	616	325.40	8.35	41.47
T_2	200.40	1.44	629	322.10	8.62	41.52
T_3	198.35	1.39	612	325.50	8.40	41.76
T_4	202.30	1.35	609	320.90	8.20	39.50
LSD(0.05)	NS	NS	8.49	NS	0.31	-
CV (%)	8.52	7.29	4.99	5.41	6.59	-

T_1= Maize (100%) + one row garden pea (33%) in between maize lines, T_2= Maize (100%) + two row garden pea (66%) in between maize lines, T_3= Maize (100%) + garden pea broadcast (100%) in between maize lines and T_4= Sole maize

Yield of garden pea was reduced due to reduction in plant population in intercropping situations. Garden pea yield was decreased by 32.59 to 54.41 % than sole crop due to receipt lower amount of incoming solar radiation as well as lower number of plants in intercropping systems. Yield was mostly affected due to tall maize plants shaded the short statured garden pea plants which affected the rate of photosynthesis and thereby translocation of photosynthates from source to sink. Patra *et al*. (2000) also recorded lower number of pods plant^{-1}, seeds pod^{-1} and decreased in yield of soybean, green gram, groundnut and black gram due to intercropping legumes with maize as compared to their monoculture which corroborated the present findings. Sole crop of garden pea recorded the highest harvest index (31.80 %) among the treatments. The harvest index of garden pea had higher value in T_5>T_2>T_3 >T_1.

Maize and garden pea equivalent yield

Maize and garden pea equivalent yield were recorded to be higher in all intercropping systems with respect to pure stand yield of their corresponding sole crops yields (Table 3). The highest maize equivalent yield (20.22 t ha^{-1}yr^{-1}) as well as garden pea equivalent yield (7.58 t ha^{-1}yr^{-1}) were recorded from maize (100 %) + two rows of garden pea (66 %) in between maize lines (T_2) which covered the yield advantages of 147 and 18 % over their respective sole crops. Such yield advantage might be due to combined yield of both the crops. Similarly, Chalka and Nepalia (2005) also observed that introduction of different legume crops did not affect yield attributes and yield of maize but significantly increased maize equivalent yield.

Table 2. Yield attributes, pod yield and harvest index of garden pea as influenced by different intercropping systems at Mymensingh during 2015-16 and 2016-17 (pooled)

Treatment	Plant heigh (cm)	Pods plant^{-1} (no.)	Seeds pod^{-1} (no.)	1000-seeds weight (g)	Pod yield (t ha^{-1})	Harvest index (%)
T_1	43.33	12.11	3.41	284.35	2.94	23.35
T_2	38.39	11.98	3.24	296.57	4.35	27.43
T_3	37.43	11.22	3.12	284.31	3.86	26.10
T_5	56.68	16.34	3.55	322.18	6.45	31.80
LSD(0.05)	5.38	1.18	0.68	3.14	0.83	-
CV (%)	7.12	5.46	6.68	6.12	6.84	-

T_1= Maize (100%) + one row garden pea (33%) in between maize lines, T_2= Maize (100%) + two row garden pea (66%) in between maize lines, T_3= Maize (100%) + garden pea broadcast (100%) in between maize lines and T_5= Sole garden pea

Cost-benefit analysis

An increase in gross return and gross margin was found due to intercropping of garden pea with maize as compared with sole crop. Maize (100 %) + two rows of garden pea (66 %) in between maize lines (T_2) was recorded the highest monetary advantage Tk. 175697 ha^{-1} which gave an additional income of Tk. 1,21,648 ha^{-1} over sole maize and Tk. 50,448 ha^{-1} over sole garden pea (Table 3). Total cultivation cost was lower in sole crop and higher in intercropping treatments might be due to inclusion of component crop. Intercropping of garden pea brought about an increase in return per taka investment. It was evident that intercropping was always beneficial and recorded higher benefit cost ratio (BCR) with respect to monoculture of maize and garden pea. Among the intercropping systems, maize (100 %) + two rows of garden pea (66 %) in between maize lines (T_2) obtained the highest benefit cost ratio of 2.29 which further indicated the superiority to T_2 over other treatments. These results are in agreement with the findings of Bharati *et al*. (2007) who stated that maize based intercropping gave higher net return than sole crop of maize. Similarly, Maize+legume intercropping was more productive and remunerative as compared to sole cropping stated by Kamanga *et al*. (2010), which was in close agreement with the present findings.

Land Equivalent Ratio (LER): The values of land equivalent ratio (LER) in different intercropping systems were found to be greater than unity indicating higher land use efficiency of intercropping systems over the respective monoculture (Table 4). Yield advantages occurred in intercropping was mainly due to the development of both temporal and spatial complementarities.

However, the total LER value (1.56) was highest in maize (100 %) + two rows of garden pea (66%) in between maize lines (T_2), where maize and garden pea achieved 89 and 67 % of their sole yields, respectively indicating higher biological and economic efficiency. It also expressed that by intercropping maize with garden pea, a farmer can produce 8.62 tons maize and 4.35 tons garden pea in one hectare of land instead of growing them separately as sole crop. Nurbaksh *et al*. (2013) also found similar results in intercropping of sesame and bean.

Table 3. Equivalent yield and cost benefit analysis of maize + garden pea intercropping systems at Mymensingh (average 2015-16 and 2016-17)

Treatment	Equivalent Yield (t ha^{-1} yr^{-1})		Gross return (Tk. ha^{-1})	Total cost (Tk. ha^{-1})	Gross margin (Tk. ha^{-1})	BCR
	Maize	Garden pea				
T_1	16.19	6.07	251200	126869	124331	1.98
T_2	20.22	7.58	311920	136223	175697	2.29
T_3	18.69	7.01	288800	135660	153140	2.13
T_4	8.20	-	131200	77151	54049	1.70
T_5	-	6.45	258000	132751	125249	1.94

Input and output Price: Urea=Tk.16.00 kg^{-1}, TSP= Tk. 23.00 kg^{-1}, MoP= Tk. 16.00 kg^{-1}, Gypsum = Tk. 10.00 kg^{-1}, Zinc sulphate= Tk. 180.00kg^{-1}, Boric acid= Tk. 220.00 kg^{-1}, Maize grain= Tk. 15.00 kg^{-1} and Garden pea (green pod) = Tk. 40.00 kg^{-1}

Area Time Equivalent Ratio (ATER): The area time equivalent ratio (ATER) included the duration of the intercrops in intercropping systems in the field and also evaluated the crop yield per day basis. ATER values were found greater than unity in all the intercropping systems. Maize (100%) + garden pea (66 %) in between two lines of maize intercropping system (T_2) showed higher ATER value (1.28) which was about 8.0 and 6.0 % higher than that of ATER values obtained from T_1 and T_3 which indicating higher yield per day (Table 4). So, the intercropping system was found to be advantageous in comparison to sole crop. This was achieved due to the development of temporal as well as spatial complementary. Mohan *et al*. (2005) also reported that the LER and ATER were higher in maize + legume in 1:2 proportion than in 1:1 proportion.

System Productivity Index (SPI): The system productivity index (SPI) which standardized the yield of the secondary crop (garden pea) in terms of the primary crop (maize) and also identified the combinations that utilized the growth resources most effectively and maintained a stable yield performance (Tajudeen, 2010). The results showed that maize 100% + two rows of garden pea (66 %) in between two maize lines (T_2) intercropping system gave the highest SPI value (14.21) than other intercropping systems (Table 4). The values of SPI were higher and largely determined by maize intercrop yields which were not much reduced by intercropping with garden pea.

Replacement Value of Intercropping (RVI): Replacement value of intercropping (RVI) is one of the better measures of economic advantage of intercropping. Maximum value (6.62) of RVI was observed in maize (100 %) + two rows of garden pea (66 %) in between maize lines (T_2) intercropping system (Table 4). This implies that, farmers who practice intercropping of two rows of garden pea in between maize lines (T_2) could make 562% more profit than the farmers who are involved in maize or garden pea monoculture.

Monetary Advantage Index (MAI): The monetary advantage index (MAI) values were positive in all intercropping systems (Table 4). The result also gives an indication of the yield and economic advantages in maize-garden pea intercropping systems over their sole cropping. The highest MAI (Tk. 1,11,971 ha^{-1}) was obtained in maize (100 %) + two rows of garden pea (66 %) in between maize lines (T_2), which implied that the planting pattern was highly economical and advantageous for the mixtures. The results are in agreement with the finding of Islam *et al*. (2016) who reported that higher MAI values found in turmeric-sesame intercropping systems compared to sole cropping system. Dhima *et al*. (2007) reported that if LER and relative crowding coefficient (RCC) values were higher than there was an economic benefit expressed with MAI values such as obtained in the present study.

Table 4. Competition functions as influenced by maize + garden pea intercropping systems at Mymensingh (average of 2015-16 and 2016-17)

Treatment	LER values			ATER	SPI	RVI	MAI (Tk. ha^{-1})
	Maize	Garden pea	Total				
T_1	0.93	0.46	1.39	1.18	12.09	5.30	70,481
T_2	0.89	0.67	1.56	1.28	14.21	6.62	1,11,971
T_3	0.86	0.60	1.46	1.21	13.31	6.12	90,992
T_4	1.00	00	1.00	-	-	-	-
T_5	00	1.00	1.00	-	-	-	-

Aggressivity (A): The competitive ability of the component crops in an intercropping system is determined by its aggressivity value. Regardless of the intercropping system, there was a positive sign for maize and a negative sign for garden pea indicating that maize was dominant crop (+ve) while garden pea appeared as dominated crop (-ve). Higher aggressivity value (0.426) was calculated with maize (100 %) + broadcast of garden pea (100%) in between maize lines (Table 5). Results showed positive aggressivity for maize at (100%) + two rows of garden pea (66%) in between maize lines and maize (100%) + broadcast of garden pea (100%) in between maize lines planting pattern while it proved less competitive and was dominated by garden pea at maize (100 %) + one line garden pea (33%) in between maize lines.

Competitive Ratio (CR): The competitive ratio values showed variation among the intercropping indicating differential competitive ability of component crop as influenced by intercrops of garden pea (Table 5). Garden pea showed higher value of CR (0.70-1.50) than maize (0.67-1.43) indicating garden pea as the best competitor than maize. Consequently, maize (100%) + one row of garden pea (33%) in between two maize lines (T_1) intercropping system with higher difference of CR (0.83) exhibited dissimilarities in competitiveness between the component crops. However, Maize (100%) + two rows of garden pea (66%) in between maize lines (T_2) intercropping system with lower difference of CR (0.56) showed merely similar competitiveness between the component crops. The results expressed that similar competitiveness with minimum CR between component crops provided complementary utilization of growth resources for better performance of intercropping with higher productivity. These results are in agreement with the findings of Islam *et al*. (2016).

Table 5. Aggressivity index (A), competitive ratio (CR) and relative crowding coefficient (RCC) of maize and garden pea in maize + garden pea intercropping systems at Mymensingh (average of 2015-16 and 2016-17)

Treatment	Aggressivity index (A)		Competitive ratio (CR)			Relative Crowding Coefficient (RCC)		
	Maize	Garden pea	Maize	Garden pea	Differences	Maize	Garden pea	Total
T_1	-0.024	0.024	0.67	1.50	0.83	-18.37	2.54	46.66
T_2	0.003	-0.003	0.88	1.14	0.56	-13.55	3.14	42.55
T_3	0.420	-0.420	1.43	0.70	0.73	-42.00	1.49	62.58
T_4	-	-	-	-	-	-	-	-
T_5	-	-	-	-	-	-	-	-

T_1= Maize (100%) + one row garden pea (33%) in between maize lines, T_2= Maize (100%) + two row garden pea (66%) in between maize lines, T_3= Maize (100%) + garden pea broadcast (100%) in between maize lines and T_5= Sole garden pea

Relative Crowding Coefficient (RCC): Relative crowding coefficient (RCC) of maize and garden pea was more than unity indicating greater non-competitive interference than the competitive one. The intercropped garden pea had higher relative crowding coefficient values than the intercropped maize. Negative relative crowding coefficient values for maize were obtained in all intercropping systems (Table 5). In this study, 100 % maize + 100 % garden pea (T_3) had the maximum RCC value (62.58) and after that 100% maize + 33% garden pea (T_1) and100% maize + 66 % garden pea (T_2) with 46.66 and 42.55, respectively.

Conclusion

From the experimental findings it can be concluded that the productivity of unit land area is increased by intercropping rather than monocultures. Maize intercropped with garden pea produced higher grain yield than maize sole crop. The competitive functions also showed that intercropping had a major advantage over sole cropping. So, for optimum and sustainable productivity and profitability of maize-garden pea intercrop combinations, a planting pattern comprising of maize (100 %) + two rows of garden pea (66%) in between maize lines (T_2) could be suitable combination in Old Brahmaputra Floodplain (AEZ-9) to increase land use efficiency and maximum profit.

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