Reprint ISSN 1997-2571 (Web Version)

Journal of Innovation & Development Strategy (JIDS)

(J. Innov. Dev. Strategy)

Volume: 9	Issue: 1	April 2015

J. Innov. Dev. Strategy 9(1): 1-4 (April 2015)

INFLUENCE OF MANGO-BASED AGROFORESTRY SYSTEM AND SPACING ON THE GROWTH AND YIELD PERFORMANCE OF WHEAT (*Triticum aestivum* L. var. BARI Gom 26)

Z.A. ZENI, M.S. RAHMAN, M.R. ISLAM, M.M. ALI AND K.C. PODDER

An International Scientific Research Publisher

Green Global Foundation©

Web address: http://ggfjournals.com/e-journals archive
E-mails: editor@ggfjournals.com and editor.int.correspondence@ggfjournals.com

ISSN-1997-2571 (Online)
J. Innov. Dev. Strategy 9(1):1-4(April 2015)

INFLUENCE OF MANGO-BASED AGROFORESTRY SYSTEM AND SPACING ON THE GROWTH AND YIELD PERFORMANCE OF WHEAT (*Triticum aestivum* L. var. BARI Gom 26)

Z.A. ZENI, M.S. RAHMAN*, M.R. ISLAM, M.M. ALI AND K.C. PODDER

Department of Agroforestry and Environment, Hajee Mohammad Danesh Science and Technology University, Dinajpur-5200, Bangladesh.

*Corresponding author & address: Md. Shoaibur Rahman, E-mail: shoaib_for@yahoo.com
Accepted for publication on 5 March 2015

ABSTRACT

Zeni ZA, Rahman MS, Islam MR, Ali MM, Podder KC (2015) Influence of mango-based agroforestry system and spacing on the growth and yield performance of wheat (*Triticum aestivum* L. var. BARI Gom 26). *J. Innov. Dev. Strategy.* 9(1), 1-4.

The present study was carried out to evaluate the influence of mango-based agroforestry system and plant spacing on the growth and yield performance of wheat variety BARI Gom 26 (*Triticum aestivum* L.) Wheat seeds were sown in lines at three different spacing *viz.* 15, 20 and 25 cm with two production systems namely open field (sole cropping) and wheat and mango based production system. Plant height of wheat was found significantly higher under mango based production system (93 cm) compared to wheat sole cropping (33.33 cm). On the other hand plant height did not vary significantly due to spacing. Leaf length was also significantly higher in mango based system (36.67 cm) compared to open field (31 cm). However, higher yield ha^{-1} of wheat was found in mango based system (3.59 tons) compared to open field (3.52 tons) but there was no statistical variation between them. Finally it may be concluded that though intercropping of wheat with Amrapali mango tree increased vegetative growth and but there was no variation of grain yield of wheat.

Key words: *wheat, amrapali mango tree, spacing, spikelet, tiller, growth, yield*

INTRODUCTION

Wheat (*Triticum aestivum* L.) is widely intercropped cereal crop. It occupies second position of grain producing crop in Bangladesh. Though Bangladesh is totally dependent on agriculture, the sole cropping land is decreasing day by day due to high pressure from increasing population and urbanization, coupled with land degradation and climate change are the major causes for food insufficiency in developing world. Among different approaches to combat this problem, woody perennial based production systems i.e agroforestry has the great potential. Agroforestry, the combination of woody perennials with crops and/or animals on the same unit of land management, is an age-old practice in Bangladesh. The systems not only arrest land degradation but also improve site productivity through interactions among trees, soil, crops, and livestock (Kumar 2006). This is the most important way to practice agriculture without deteriorating agro-diseases and environmental degradation (Garrity 2004).

Wheat (*Triticum aestivum* L.) is the most important food crop under agroforestry system in Bangladesh. It supplies carbohydrate, protein, minerals and vitamin (BARI 1997) and preferable to rice for its higher seed protein content. It contributes about 60 per cent of daily protein requirement and more calories to world human diet than any other food crops (Mattern *et al.* 1970).

Mango fruit plays an important role in the dietary. Generally the canopy of mango is spacious. Consequently, agroforestry system based on mango tree is not common. On the other hand, the canopy of amrapali mango tree is short and narrow. Rotation time of this tree is also very short. Hence, amrapali mango tree may be a good component of agroforestry in Bangladesh especially in the northern region. So, the current research was carried out in the amrapali mango tree orchard to determine the effect of mango based agroforestry system and wheat spacing on growth of BARI Gom 26 and finally to find out the yield performance of wheat in mango orchard compared to open field.

MATERIALS AND METHODS

The research was conducted at the Agroforestry Research Field, Hajee Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh. The geographical location of the site is between 25º 13' latitude and 88º 23' longitude, and about 37.5 m above the sea level during December 2013 to March 2014. The experimental plot was in a medium high land belonging to the old Himalayan Piedmont Plain area (AEZ - 01) comprising sandy loam texture with pH 5.1. The site is characterized by tropical climate characterized by heavy rainfall from July to August and scanty rainfall the rest period of the year 80 to 90% is received between June and September. The remaining 10 to 20% rainfall is received during wheat-growing season (November to April). Wheat seeds (BARI Gom 26) were collected from wheat research centre, Nashipur, Dinajpur and cultivated with two factors i.e. production system (sole wheat i.e. open and with mango field) and spacing (S_1 = 15 cm, S_2 = 20 cm, S_3 = 25 cm from the mango tree base). Land Preparation, seed sowing was done followed by standard procedures (Chaudhry 2003). Intercultural operations were done when needed. Data were collected for times i.e. after 30, 45, 60 and 75 days after planting. The plants were harvested on 3rd March 2014. The harvested crop of each plot was bundled and then threshing, cleaning, winnowing and drying of seeds were done carefully. Five plants were randomly selected from each plot & data of growth and yield were recorded. The statistical analysis "ANOVA" was done following RCBD design with the help of MSTAT-C programme. The means were adjusted by Duncan's New Multiple Range Test (Gomez and Gomez, 1984).

RESULTS & DISCUSSION

Plant height (cm)

Plant height of wheat was found significantly higher only after 30 days in mango based system than open field but it did not vary significantly in spacing treatments. In case of interaction between production system and spacing, plant height was significantly higher in mango-wheat intercropping system comparing with wheat open field (Table 1) as there was no effect of spacing on plant height. After 45, 60 and 75 days, highest plant height of wheat was recorded as 93.00 cm in mango tree intercropping system after 75 days compared to 33.33 cm after 30 days in sole cropping. The higher plant height of wheat in mango based agroforestry system may be due to moisture variation and competition for solar radiation between the component crops (Chaudhry 2003).

Table 1. Effect of production systems and spacing on the plant height of wheat

Interaction factors		Plant height (cm)			
Production System	Wheat spacing (cm)	30 days	45 days	60 days	75 days
Open	S_1	34.00 c	48.33	66.67	89.50
	S_2	33.33 c	48.50	54.83	88.33
	S_3	34.83 bc	46.50	63.50	84.00
Mango based	S_1	38.33 ab	51.17	66.00	84.00
	S_2	39.67 a	52.10	53.17	93.00
	S_3	40.00 a	50.50	69.17	90.50

(Note: S_1= 15 cm, S_2= 20 cm and S_3= 25 cm; same letter (s) or no letter in a column indicate statistically non-significant at $P\leq0.05$)

Leaf number

Leaf number did not vary statistically among the interaction treatments in different growth periods except after 60 days. This may be due to the variation of field moisture, light or other errors. But the variation was very little and is negligible. The previous trend of leaf number was obtained after 75 days where the number of leaf again became statistically similar among all treatments (Table 2).

Table 2. Effect of production systems and spacing on the leaf number of wheat

Interaction factors		Leaf number			
Production System	Wheat spacing (cm)	30 days	45 days	60 days	75 days
Open	S_1	4.00	5.00	6.00 ab	5.67
	S_2	4.33	5.00	4.67 c	5.33
	S_3	4.33	5.00	5.33 bc	5.67
Mango based	S_1	4.67	4.67	6.67 a	4.00
	S_2	4.67	5.00	6.33 ab	5.33
	S_3	4.67	4.67	6.33 ab	5.00

(Note: S_1= 15 cm, S_2= 20 cm and S_3= 25 cm; same letter (s) or no letter in a column indicate statistically non-significant at $P\leq0.05$)

Leaf length

Leaf length was statistically same between the two production systems in different time periods except 75 days. After 75 days it showed significant difference and leaf length was higher in mango based system than in open field but it did not vary significantly in different spacing (Table 3). After 75 days leaf length was higher in S_1 and S_3 spacing in mango based system than in open field.

Table 3. Effect of production systems and spacing on the leaf length of wheat

Factors		Leaf Length (cm)			
Production System	Spacing(cm)	30 days	45 days	60 days	75 days
Open	S_1	25.50	28.33	32.67	31.00 b
	S_2	24.83	27.33	34.00	32.67 ab
	S_3	25.17	26.00	32.00	32.00 ab
Mango based	S_1	26.33	27.67	32.33	36.67 a
	S_2	27.17	28.00	32.33	36.00 ab
	S_3	26.83	28.33	34.67	36.67 a

(Note: S_1= 15 cm, S_2= 20 cm and S_3= 25 cm; same letter (s) or no letter in a column indicate statistically non-significant at $P\leq0.05$)

Number of Tiller

Tiller number of wheat per plant did not differ significantly in different growing periods of wheat between mango based and open field system (Fig. 1). Similar result was recorded in different spacing treatments also (Fig. 2). In our experiment, as Amrapali mango tree was four years old and its canopy size was small, there was not much shade effect on the wheat crop. That is why wheat tiller number was not affected by intercropping practice. Similar result was obtained by some researchers such as Chaudhry (2003); Sharma *et al.* (1996).

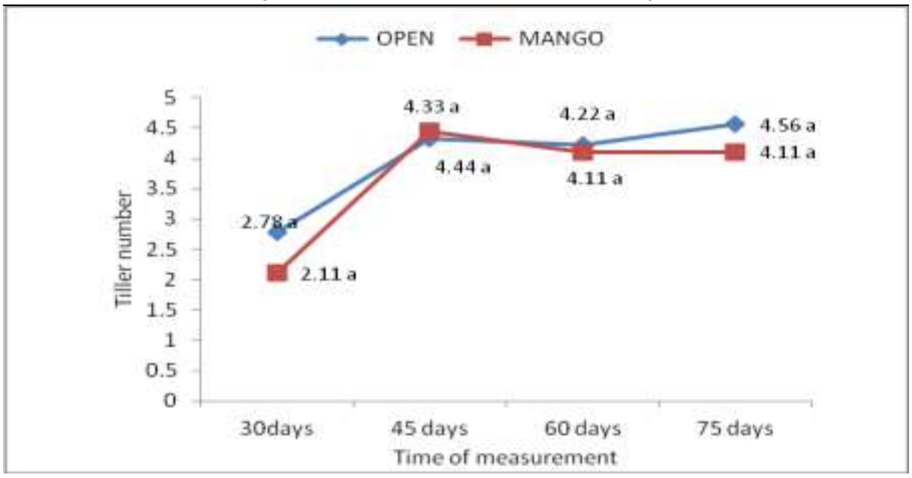

Fig. 1. Effect of mango based production system on the tiller number of wheat (BARI Gom 26) in different time periods

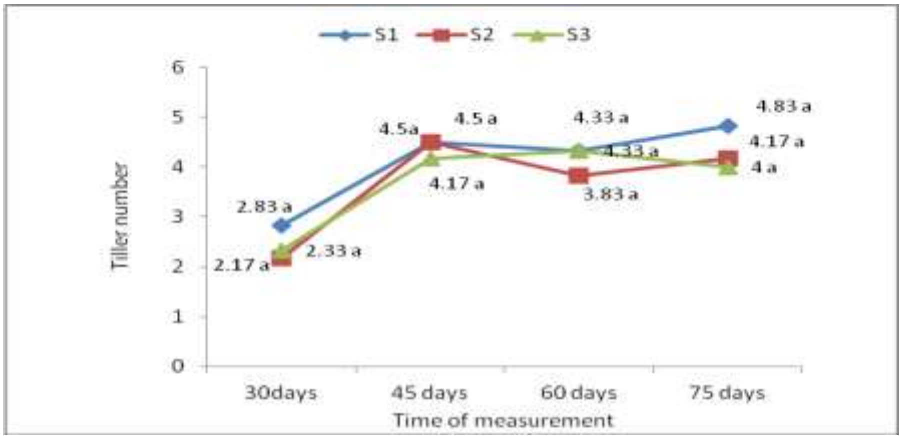

Fig. 2. Effect of spacing on the tiller number of wheat (BARI Gom 26) in different time periods (S_1= 15 cm, S_2= 20 cm and S_3= 25 cm)

Spikelet length and Number

Spikelet length varied significantly among the interaction treatments of the two factors (i.e. production system and spacing). Highest length was found in the S_1 and S_3 spacing of open field and in mango based system all the treatments showed highest length of spikelet. Effective spikelet number was statistically non significant among the interaction system (Table 4).

Table 4. Effect of interaction between the production systems and spacing on the spikelet and grain yield of wheat

Interaction factors		Spikelet		Grain	
Production System	Wheat spacing (cm)	Length (cm)	Effective number	1000-grain weight (g)	Yield ha^{-1} (tons)
Open	S_1	10.83 ab	45.67	27.80b	3.52
	S_2	10.17 b	38.33	27.83b	3.52
	S_3	12.33 a	40.00	27.90b	3.53
Mango based	S_1	12.00 ab	44.00	29.00a	3.59
	S_2	10.67 ab	39.67	29.07a	3.60
	S_3	11.33 ab	42.67	28.83a	3.59

(Note: S_1= 15 cm, S_2= 20 cm and S_3= 25 cm; same letter (s) or no letter in a column indicates statistically non-significant at $P \leq 0.05$)

Grain weight and yield

In this experiment we recorded 1000 grain weight of wheat variety BARI Gom 26 was found statistically different in both mango based and open field systems. But they were insignificant due to spacing treatments of wheat (Table 3). Previous studies showed that 1000-grain weight is not controlled genetically alone but it is the environmental conditions, which have main effects on the expression of this trait (Halverson and Zeleny, 1988). Similarly, Butt *et al.* (1997) have reported the variation in 1000-grain weight, occurred due to differences in crop years. The yield per hectare of wheat did not differ significantly due to production systems and spacing. But numerically higher yield (3.60 t ha^{-1}) was found from mango based system with S_3 spacing treatment. The crop growth is mainly affected by light and nutrient availability. Leaf litter inputs from agro-forestry trees could provide sufficient nutrients and organic matter to sustain crop growth that may improve crop yield. Similar results were observed by (Lehmann *et al.* 2002; Bhardwaj *et al.* 2005; Sarvade *et al*. 2014).

CONCLUSION

The findings of the present investigation indicates that growing of wheat as ground layer crop in Amrapali mango tree orchard is a viable option because wheat plant's morphological growth was not affected. Wheat grain yield also did not vary significantly among the production systems and three different spacings i.e. 15 cm, 20 cm and 25 cm but it provided more output when grown both of them at a time. So it may be concluded that agroforestry is a preferable option to get higher total yield of wheat and mango.

REFERENCES

BARI (Bangladesh Agricultural Research Institute) (1997) Means of profitable wheat cultivation. Wheat Research Centre. Booklet of Bangladesh Agricultural Research Institute, Nashirpur, Dinajpur. pp. 1-11 (Bengali version).

Bhardwaj BB, Gupta SR, Saini R, Sodhi JS, Singh A (2005) Nutrient dynamics in a populus deltoides agroforestry system at Kurukshetra. *Bulletin of the National Institute of Ecology*, 15, 99-108.

Butt MS, Anjum FM, Atta-ur-Rehman, Ali A (1997) Physio-chemical characters of Spring Wheat. *Journal of Agricultural Research*, 35(6), 414-421.

Chaudhry AK (2003) Comparative Study of Different Densities of Poplar in Wheat Based Agroforestry System in Central Punjab. M.S. Thesis. University of Agriculture, Faisalabad – Pakistan.

Garrity DP (2004) Agroforestry and the achievement of the millennium development goals. *Agroforestry Systems*, 61, 5-17.

Gomez KA, Gomez AA (1984) *Statistical procedures for agricultural research*. (2nd eds) John Wiley and Sons. Inc., New York. p. 680.

Halverson J, Zelany L (1988) Criteria of Wheat Quality. P.15-46 In: *Wheat Chemistry Technology*. Y. Promaranz (ED.) Amer. Assoc. Cereal Chem. Inc., St. Paul, Minnesota.

Kumar BM (2006) Agroforestry: the new old paradigm for Asian food security. *Journal of Tropical Agriculture,* 44(1-2), 1-14.

Lehmann J, Gebauer G, Zech W (2002) Nitrogen cycling assessment in a hedgerow intercropping system using 15N enrichment. *Nutrient Cycling in Agro-ecosystems*, 62, 1-9.

Mattern PPJ, Schmidt JW, Johnson VA (1970) Screening for high lysing content in wheat. *Cereal Science Today*, 15, 409.

Sarvade S, Mishra HS, Kaushal R, Chaturvedi S, Tewari S, Jadhav TA (2014) Performance of wheat (*Triticum aestivum* L.) crop under different spacings of trees and fertility levels. *African Journal of Agricultural Research*, 9(9), 866-873.

Sharma KK, Khanna P, Ajoy Gulati (1996) The Growth and Yield of Wheat and Paddy Influenced By *Dalbergia sisso* Roxb. Boundary Plantation. *Indian Forester*, 122(12), 1114-1225.