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Effect of agri-horti systems and weed management practices on density and biomass of weeds in mungbean in Eastern Uttar Pradesh

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ABSTRACT

An experiment was conducted to study the effect of two agri-horti systems and weed management practices on density and biomass of different weeds in mungbean in Eastern Uttar Pradesh. Custard apple agri-horti system recorded higher density and biomass grasses, sedges and broad leaved weeds. Weed management treatments significantly affected growth and biomass of grasses, sedges and broad leaved weeds. One hand weeding (20 DAS) recorded significantly lowest grasses, sedges and broad leaved weeds followed by imazethapyr at 125 g.ha^{1} and pendimethalin at 1000 g.ha^{1}, however significantly maximum grasses, sedges and broad leaved weeds were recorded under weedy check.

Keywords: Agri–horti system, greengram, herbicide and legume

Mungbean, an important legume of Asian origin (Yang et al., 2008) is widely cultivated in various climate and geographical regions of India. India is the world's largest grower of pulse crops (food legumes) covering about 23.0 million hectares and producing about 18.1 million tons with the productivity 694 kg.ha^{1} (Reddy, 2012). Mungbean serves as Vital source of vegetable protein (19.1-28.3%) and Vitamins (Singh *et al.,* 2015). It is a feasible option as an intercrop in the alleys of agri-horticultural plantation and provides extra income, improves soil fertility, enabling the main crop to give a better yield compared with the sole crop of sugarcane/banana/tapioca (Muthiah, 2004). However, mungbean production is seriously constrained with weeds, which account for 30-50 per cent of yield loss (Sekhon *et al*., 2004). It was observed that species combinations and importance of weed communities differwith agroforestry system because; some studies have documented inhibitory allelopathic effects of trees on weed germination and growth (Kaur *et al*. 2011). Allelopathic interaction of agroforestry species may also effect the components (annual plants) of agroforestry systems though information in this regard is limited. Superior knowledge of companionable agroforestry species very much facilitates formulation of agroforestry systems with advanced yields. Knowledge concerning these important issues may help in executing 'cautious' weed management and improving yield of mungbean. Present studies were aimed to study the effect of agri-horti system and weed management practices on density and biomass of grasses, sedges and broad leaved weeds in mungbean crop.

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MATERIALS AND METHODS

Field experiment was carried out during *kharif* season of 2010 at the Research Farm of Rajiv Gandhi South Campus (Banaras Hindu University), Barkachha, Mirzapur, Uttar Pradesh, India. Experimental site was located 25^{0}N and 85^{0} E at an elevation of 365 m above MSL. The predominant soil in the experimental field is sandy clay loam classified as Inceptisol (Typic Ustochrept) in texture, slightly acidic in reaction (pH 6.4), low in organic carbon content (0.27 %) and medium in available P (10.15kg.ha^{1})and K (185.7 kg.ha^{1}) contents. During the crop season total rainfall received was 460.40 mm, out of which more than 40 per cent received between 33rd to 36th Standard Meteorological Weeks (SMW). The mean maximum temperature during the crop growth season ranged from 30.70-32.30^{0}C whereas, mean minimum temperate ranged between 16.50 - 25.80^{0}C. The maximum and minimum relative humidity varied between 82.20-87.30 per cent and 49.50-74.90 per cent, respectively. The average duration of bright sunshine received was 6.475 hour day^{1} The experiment was laid out in a split plot randomized complete block design, where agri-horticultural system *i.e.* custard apple and guava were assigned as main-plot factors, whereas four weed control treatments [Pendimethalin at 1000 g.ha^{-1} (PE), Imazethapyr 125 g.ha^{-1} (PoE *i.e.,* 20 DAS), weedy check, one hand weeding (20 Days After Showing in mungbean)] were randomly allocated to subplots and each treatment was replicated thrice. In alleys of custard apple and guava agri-horti system mungbean crop (variety: *Pant Mung–2*) was sown, Plot size of

Table 1: Effect of agri-horti system and weed management practices on density and biomass of grasses in mungbean.

Treatments	Density (No. m^{-2})				Biomass (g m^{-2})			
	20 DAS	40 DAS	60 DAS	At harvest	20 DAS	40DAS	60 DAS	At harvest
Agri-horti system (S)								
Custard Apple	7.35((56.67)	16.21(237.50)	15.75(233.33)	12.27(135.83)	6.42(43.68)	5.34(19.25)	4.77(14.75)	4.24(11.04)
Guava	7.28(53.33)	14.88(208.33)	11.70(120.83)	8.36(71.67)	4.71(18.68)	4.44(12.84)	3.41(7.02)	2.77(4.24)
SEm(±)	**0.21**	**0.34**	**0.49**	**0.13**	**0.29**	**0.13**	**0.19**	**0.16**
LSD (0.05)	**1.31**	**NS**	**2.98**	**0.80**	**1.75**	**0.80**	**NS**	**NS**
Weed management practices (M)								
Pendimethalin at 1000 g.ha^{1}	8.45(56.67)	17.56(276.67)	14.86(208.33)	11.85(118.33)	5.54(36.00)	5.33(19.20)	4.35(11.58)	3.94(8.77)
Imazethapyr at 125 g.ha^{1}	9.49(73.33)	14.25(181.67)	13.67(165.00)	8.14(53.33)	6.94(21.43)	4.96(15.83)	3.68(7.60)	3.09(5.42)
Weedy check	10.32(90.00)	17.73(316.67)	17.17(266.67)	14.38(186.67)	8.76(66.08)	5.39(19.43)	4.89(16.52)	4.38(12.37)
Hand weeding 20 DAS	1.00(0.00)*	11.65(116.67)	9.18(68.33)	6.87(56.67)	1.00(0.00)*	3.38(9.65)	3.44(7.93)	2.61(4.07)
SEm(±)	**0.48**	**0.62**	**0.68**	**0.53**	**0.29**	**0.25**	**0.21**	**0.26**
LSD (0.05)	**1.46**	**1.92**	**2.10**	**1.64**	**0.89**	**0.78**	**0.65**	**0.81**
SxM	**NS**	**S**	**NS**	**S**	**NS**	**NS**	**NS**	**NS**

Table 2: Effect of agri-hortisystem and weed management practices on density and biomass of sedges (Cyperus rotundus) in mungbean.

Treatments	Density (No. m^{-2})				Biomass (g m^{-2})			
	20 DAS	40 DAS	60 DAS	At harvest	20 DAS	40DAS	60 DAS	At harvest
Agri-hortisystem (S)								
Custard Apple	8.48(80.00)	12.56(147.50)	9.90(94.17)	6.08(37.50)	2.35(3.24)	3.15(6.12)	2.74(3.82)	2.33(2.61)
Guava	4.95(21.67)	3.21(20.00)	2.85(15.00)	2.47(9.17)	1.50(0.37)	1.63(1.73)	1.58(1.43)	1.67(1.33)
SEm(±)	**0.24**	**0.37**	**0.23**	**0.22**	**0.07**	**0.06**	**0.07**	**0.09**
LSD (P=0.05)	**1.47**	**2.25**	**1.43**	**1.35**	**0.45**	**0.38**	**0.43**	**0.54**
Weed management practices (M)								
Pendimethalin at1000 g.ha^{-1}	7.17(41.67)	8.33(108.33)	4.15(20.00)	3.24(10.00)	1.70(0.85)	2.27(4.38)	2.19(3.02)	1.77(1.22)
Imazethapyr at 125 g.ha^{-1}	9.02(76.67)	8.04(100.00)	5.97(50.00)	3.24(10.00)	2.51(2.78)	1.84(1.78)	1.95(1.87)	1.84(1.45)
Weedy check	9.62(85.00)	11.29(110.0)	11.9(13.67)	9.11(71.67)	2.50(3.58)	3.60(7.20)	3.22(5.17)	3.20(5.02)
Hand weeding 20 DAS	1.00(0.00)*	3.88(16.67)	3.40(11.67)	1.53(1.67)	1.00(0.00)*	1.84(2.32)	1.27(0.45)	1.18(0.20)
SEm(±)	**0.48**	**0.39**	**0.32**	**0.30**	**0.09**	**0.14**	**0.17**	**0.15**
LSD (0.05)	**1.49**	**1.21**	**0.98**	**0.94**	**0.28**	**0.44**	**0.51**	**0.47**
SxM	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

*Data were subjected to square root transformation. Data given in parenthesis are original value. *Observation were recorded just after weeding of crop*

Table 3: Effect of agri-horti system and weed management practices on density and biomass of broad leaf weeds *(Trianthema monogyna)* in mungbean.

Treatments	Density (No. m^{-2})				Biomass (g m^{-2})			
	20 DAS	40 DAS	60 DAS	At harvest	20 DAS	40DAS	60 DAS	At harvest
Agri-horti system (S)								
Custard Apple	4.57(17.50)	10.73(105.0)	7.78(53.33)	4.30(15.83)	2.64(3.77)	3.49(6.67)	2.88(4.31)	2.02(1.48)
Guava	4.08(15.00)	5.47(33.3)	5.57(29.17)	3.81(10.83)	2.10(2.29)	2.11(1.89)	2.64(3.79)	1.77(0.95)
SEm(±)	**0.23**	**0.33**	**0.25**	**0.13**	**0.62**	**0.12**	**0.15**	**0.09**
LSD (0.05)	**NS**	**2.03**	**1.56**	**NS**	**0.35**	**0.72**	**NS**	**NS**
Weed management practices (M)								
Pendimethalin at 1000 g.ha^{-1}	4.46(15.00)	9.77(78.33)	7.09(38.33)	4.60(13.33)	1.93(1.33)	2.96(4.40)	3.08(4.68)	2.61(2.73)
Imazethapyr at 125 g.ha^{-1}	5.73(23.3)	7.89(68.33)	6.02(33.33)	3.54(10.00)	3.32(5.78)	2.82(4.33)	2.80(3.60)	1.94(1.02)
Weedy check	6.12(26.7)	11.15(116.67)	8.08(65.00)	6.08(26.67)	3.23(5.00)	3.39(6.00)	3.29(5.85)	2.03(1.10)
Hand weeding 20 DAS	1.00(0.00)*	3.44(13.33)	4.72(28.33)	2.05(33.33)	1.00(0.00)*	2.03(2.50)	1.89(1.70)	1.00(0.00)
SEm(±)	**0.32**	**0.43**	**0.35**	**0.25**	**0.18**	**0.12**	**0.22**	**0.09**
LSD (0.05)	**0.99**	**1.32**	**1.09**	**0.77**	**0.55**	**0.72**	**0.69**	**0.27**
SxM	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

*Data were subjected to square root transformation. Data given in parenthesis are original value. *Observation were recorded just after weeding of crop.*

Table 4: Biometrical observations on custard apple and guava plantation.

	Custard apple plantation									
	Plant height(m)		Number of branches		Canopy diameter(m)		Crown length(m)		Girth(m)	
	At time of sowing of mung bean[a]	At harvest of mung bean[b]	At time of sowing of mung bean[a]	At harvest of mung bean[b]	At time of sowing of mung bean[a]	At harvest of mung bean[b]	At time of sowing of mung bean[a]	At harvest of mung bean[b]	At time of sowing of mung bean[a]	At harvest of mung bean[b]
Mean	2.30	2.60	3.0	3.29	2.78	3.15	2.16	2.18	0.21	0.22
Range	1.2-2.80	1.4-2.95	2-4	2-6	1.5-2.9	1.8-3.45	1.05-2.7	1.15-2.75	0.15-0.24	0.16-0.24
SD	0.39	0.56	1.18	1.20	0.38	0.41	0.40	0.44	0.02	0.02
Guava plantation										
Mean	2.49	2.54	4.08	4.17	3.06	3.10	2.23	2.24	0.22	0.22
Range	2.25-2.57	2.3-2.65	2-7	3-7	3-3.1	3.05-3.15	2.0-2.35	2.05-2.36	0.20-0.24	0.20-0.24
SD	0.11	0.11	1.38	1.27	0.03	0.03	0.10	0.09	0.02	0.02

a: Observation recorded on 12.08.2010, b: Observation recorded on 20.10.2010.

custard apple agri-horti system was 3.0 × 4.0 m and guava agri-horti system was 5.1 × 4.0 m. Data collected were tabulated and statistically analyzed as per the standard statistical procedure suggested by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Data presented in table-4 showed that both the agri-horti system plantation is of similar age and similar above-ground morphology (*i.e.* tree height, canopy diameter, number of branches, crown length and girth) Table 4. but in general custard apple agri-horti system recorded higher density and biomass of *Cynodon dactylon, Echinochloa colonum, Cyperus rotundus* and *Trianthema monogyna* as compared to guava based agri-horti system. Result clearly indicates that above-ground morphology of tree has played no role on diversity, intensity and biomass accumulation by weeds under (Table 4) different canopy. In fact, Kaur *et al*., 2011 reported that trees can regulate the germination and growth and development of weeds by allelopathy. It is expected that guava agri-horti system released certain allelochemical in root rhizosphere which is likely to inhibit the growth of some of the weed species. These results were in conformity with the findings of allelopathic studies conducted on custard apple (*Annona squamosa*) (Rizvi *et al*. 1980) and guava (*Psidium guajava*) (Brown *et al*. 1983), where extract of these trees selectively inhibited growth of some specific weed species. Among the in weed management practices one hand weeding (20 DAS) recorded the lowest density and biomass of grasses (*Cynodon dactylon, Dactyloctenium aegyptium* and *Echinochloa colonum*), broad leaved (*Trianthema monogyna*), and sedges (*Cyperus rotundus*). Similar result of lowest density and biomass of *Echinochloa colonum* with one hand weeding was reported by Rao and Rao (2006) in black gram. During the crop growth period, application of imazethapyr at125 g.ha^{1} effectively reduced biomass and density of broad leaved weed (BLWs) (*Trianthema monogyna*) and grasses (*Cynodon dactylon* and *Echinochloa colonum*) in particular and was also found significantly superior over application of pendimethalin at 1000 g.ha^{1}. Prior studies; Singh and Kumar 2008 and John *et al.,* 1989 reported that the application of imazethapyr (50-140 g.ha^{1}) gave effective control of broad leaf and grasses in soybean respectively. Weedy check recorded higher weed density and biomass of *Trianthema monogyma, Cynodon dactylon, Cyperus rotundus, Dactyloctenium aegyptium, Echinochloa colonum* (Table 1, 2, 3). These results are in accordance with the findings of Raman (2006). In totality, experimental results showed that one hand weeding (20 DAS) gave best results in management of weeds because weeding was performed during most critical period of crop-weed competition (*i.e.,* first 30 days of crop growth) (Singh *et al.* 1991). This critical period will lead to better crop growth and crop itself suppresed the weeds.

On the basis of finding it may be concluded that Guava based agri-horti system is superior over custard apple based agri-hortisystem with respect to weed suppression. Guava based agri-horti system effectively reduced the weed density and biomass. One hand weeding (20 DAS) recorded the lowest density and biomass of grasses (*Cynodon dactylon, Dactyloctenium aegyptium* and *Echinochloa colonum*), broad leaved weed (*Trianthema monogyna*) and sedges (*Cyperus rotundus*). Weedy check recorded higher weed density and biomass of *Trianthema monogyma*, *Cynodon dactylon*, *Cyperus rotundus*, *Dactyloctenium aegyptium*, *Echinochloa colonum*.

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