The Bioscan 9(4): 1449-1453, 2014
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.in

AGRI-HORTI SYSTEMS AND WEED MANAGEMENT PRACTICES EFFECT ON GROWTH AND YIELD OF MUNGBEAN [*VIGNA RADIATA* (L.) WILCZEK]

M. K. SINGH*, PRAVIN KUMAR AND S. K. PRASAD
Department of Agronomy, Institute of Agricultural Sciences,
Banaras Hindu University, Varanasi - 221 005 (U. P.) INDIA
e-mail: manoj.agro@bhu.ac.in

KEYWORDS
Greengram
Integrated weed management
Herbicidal weed control

Received on :
18.08.2013

Accepted on :
07.10.2014

***Corresponding author**

ABSTRACT
A field experiment was conducted during *kharif* season of 2010 at Rajiv Gandhi South Campus (Banaras Hindu University), Barkaccha, Mirzapur to study the effect of agri-horticultural system [custard apple (*Annona squamosa*) and guava (*Psidium guajava*)] and weed management practices [pendimethalin 1000 g a.i./ha (pre emergence), imazethapyr 125 g a.i./ha (post-emergence), weedy check, 1-hand weeding (20 DAS)] on mungbean. Custard apple based agri-horti system recorded higher weed-density and -biomass over guava agri-horti system. But growth, yield attribute and yield of mungbean did not influenced with agri-horti system. Significantly lowest density and biomass of weeds observed under 1-hand weeding. Imazethapyr 125 g/ha effectively reduced density and biomass of *Trianthema monogyna*, *Cynodon dactylon* and *Echinochloa colonum* and total weeds as compared to pendimethalin 1000 g/ha. Density and biomass of *Cyperus rotundus* did not differed significantly with herbicides. Application of imazethapyr 125 g/ha and 1-hand weeding produced at par plant height, number of branches/plant and harvest index of mungbean.

INTRODUCTION

Pulses in India have long been considered as the poor man's only source of protein. India is the world's largest grower of pulse crops (food legumes) covering about 23.0 million hectares and producing about 14.8 million tons (Srinivasarao *et al.*, 2007). But due to shrinking land resources along with burgeoning population it is very difficult maintain availability of pulses for the population. Under current situation introduction of pulses as an intercrop in the alleys of agri-horticultural plantation not only provides extra income but also improves soil fertility, enabling the main crop to give a better yield (Muthiah, 2004). Among pulses, mungbean being ecologically versatile is widely cultivated in various climate and geographical regions of India (Tripathi *et al.*, 2012) and was found be one of the most suitable intercrop in the alleys of agri-horti system.

However, mungbean production is seriously constrained with weeds, which account for 30-50 per cent of yield loss (Shekhon *et al.*, 2004). It was observed that species combinations and magnitude of weed communities differs with agroforestry system because trees can regulate the germination, growth and development of weeds, through allelopathy (Rizvi *et al.*, 1999). Weed menace in mungbean field is normally tackled by using manual or mechanical methods. Manual weeding being arduous, costly and time consuming and is not possible to be adopted on a large scale.

Allelopathic interaction of agroforestry species may effects the components (annual plants) of agroforestry systems though information in this regard is limited. Such information would prove useful to identify 'allelopathically compatible' agroforestry species (Rizvi *et al.*, 1999).

Greater knowledge of compatible agroforestry species greatly facilitates formulation of agroforestry systems with higher yields. Simultaneously, influence of weed management practices on weeds and crops would generate a better understanding to improve crop-weed competition. Knowledge regarding these important issues may help in executing 'cautious' weed management and improving yield of mungbean. With this backdrop, the present investigation was conducted to evaluate the effect of agro-forestry systems and weed management practices on mungbean.

MATERIALS AND METHODS

Site and soil Information

A field experiment was carried out during *kharif* (rainy) season of 2010 at Research Farm of Rajiv Gandhi South Campus (Banaras Hindu University), Barkachha, Mirzapur Uttar Pradesh, India. The experimental site was located 25ºN and 85ºE at an elevation of 365 m above mean sea level. The predominant soil in the experimental field was sandy clay loam classified as Inceptisol (Typic Ustochrept) in texture, slightly acidic in reaction (pH 6.4), low in organic carbon content (0.27 kg/ha) and medium in available P and K 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 30.70-32.30ºC whereas, mean minimum temperate ranged between 16.50-25.80ºC. 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.

Trial establishment

The experiment was laid out in a split plot randomized complete block design, where agri-horticultural system i.e. custard apple (*Annona squamosa*) and guava (*Psidium guajava*) were assigned as main-plot factors, whereas 4-weed management practices [pendimethalin 1000 g a.i./ha (pre emergence), imazethapyr 125 g a.i./ha (post-emergence), weedy check, 1-hand weeding (20 DAS)] were randomly allocated to subplots and each treatment was replicated thrice.

In alleys of custard apple (variety: Mammoth) and guava (variety: Lucknow-49) agri-horti systems, certified seed of mungbean (variety: Pant Mung-2) was intercropped on August 12, 2010. Plot size of custard apple and guava agri-horti system were 3.0x4.0 m and 5.1x4.0 m, respectively. Recommended seed rate (15 kg/ha) of mungbean was sown at 5 cm depth in open furrows made with a manual single row drill at a row spacing of 30 cm and immediately covered with soil. Before sowing, the seeds were treated with rhizobium culture as per the procedure given by Tripathi *et al.* (2012). Fertilizers were applied at the rate of 20 kg N, 60 kg P_2O_5 and 40 kg K_2O in the form of urea, single super phosphate (SSP) and muriate of potash (MOP), respectively. Whole amount of fertilizers were placed below the seed in respective rows at the time of sowing. Pendimethalin (1000 g a.i./ha) was applied as preemergence (PE) within 2-day of sowing whereas, imazethapyar (125 g a.i./ha) was applied as post-emergence *i.e.* 20 DAS. Before spraying, herbicides were dissolved in water at the rate of 500 L/ha and sprayed with a knapsack sprayer fitted with a flat-fan nozzle. Crop was harvested on October 21-23, 2010.

Biometrical observations

At harvest, various growth [plant height (cm), dry matter accumulation (g/m²), branch count (number/plant) and green trifoliate count (number/plant)], yield attributes and yield [grain count (number/pod), 1000-grain weight (g), grain yield (kg/ha) and harvest index] parameters were recorded for mungbean. Weed density and weed dry biomass were recorded as per the procedure given by Singh and Saini (2008) and presented as number/m² and g/m², respectively.

Data analysis

Data collected on crop and weed growth were tabulated and statistically analyzed as per the standard analysis of variance to draw valid conclusions (Gomez and Gomez, 1984). Heterogeneous weed (density and biomass) data were square-root transformed prior to analysis to produce a near normal distribution, although non transformed means are presented for clarity. The treatment differences were tested by 'F' test of significance on the basis of null hypothesis. Critical differences were worked out at 5 per cent level of probability where 'F' test was significant.

RESULTS AND DISCUSSION

Effect on Weed Growth

The experimental area during the cropping season was infested with 11-weed species, nine of which were annual moncot, and two annual dicot weed species. Predominant weed species among the grasses were little barnyard grass (*Echinochloa colonum* (L.) Link), bermuda grass (*Cynodon dactylon* (L.) Pers.) and crow footgrass (*Dactyloctenium aegyptium* (L.) Willd.) whereas, purple nutsedge (*Cyperus rotundus* L.) and horse purslane (*Trianthema portulacastrum* L.) among sedges and broad leaved weeds, respectively.

Agri-horti system

Data indicate that both density and biomass of *Cyperus rotundus*, *Trianthema monogyna*, *Cynodon dactylon* and total weed; as well as biomass of *Echinochloa colonum* and *Dactylectium aegyptium* were recorded higher under custard apple agri-horti system as compared to guava agri-horti system (Table 1 and 2). In totality, lower weed growth (density and biomass) observed under guava agri-horti system as compared to custard apple agri-horti system. This might be due to guava plantation releases certain allelochemicals in root rhizosphere which are responsible for selective inhibition of weed flora under agro-ecological situation of Mirzapur. Allelopathic studies also showed that extract of custard apple and (Rizvi *et al.*, 1980) and guava (Brown *et al.*, 1983) selectively inhibit growth of some specific weed species.

Weed management practices

Weedy check recorded higher weed density and biomass of *Trianthema monogyma, Cynodon dactylon, Cyperus rotundus, Dactyloctenium aegyptium, Echinochloa colonum* and total weeds. These results are in accordance with the findings of Poehlman (1991), Naeem *et al.* (1999) and Raman (2006).

Application of 1-hand weeding (20 DAS) recorded significantly lowest density and biomass both species-wise as well as total weed as compared to other treatments. This treatment gave best results because weeding was performed during critical period of crop-weed competition (*i.e.* first 30 days of crop growth) (Singh *et al.*, 1991), thus cascading effect observed in terms of better crop growth and crop lead suppression of weeds.

Application of imazethapyr 125 g/ha effectively reduced biomass and density of total weeds in general and broad leaf weed (BLW) (*Trianthema monogyna*) and grasses (*Cynodon dactylon* and *Echinochloa colonum*) in particular and was also found significantly superior over application of pendimethalin 1000 g/ha. Imazethapyr was more efficacious over pendimethalin because of number of reasons (1) imazethapyr has properties to controls many broadleaf weeds and some grasses and limited activity on legumes (Krämer and Schirmer, 2007). This was in conformity with the data that it effectively suppresses BLW and some grasses and has very less effect on *Dactylectium aegyptium* (a grassy weed) probably due to it can rapidly hydroxylate the 5'-ethyl substituent of imazethapyr (Shaner and Tecle, 2001), (2) imazethapyr has long persistence in the soil (Savage and Jordan, 1980; Goetz

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

Treatments	Weed density (number/m^2)[a]						
	Cyperus rotundus	*Trianthema monogyna*	*Echinochloa colonum*	*Cynodon dactylon*	*Dactylectium aegyptium*	Miscellaneous weed	Total weed
Agri-horti system(S)							
Custard Apple	12.56(147.50)	10.73(105.0)	11.3(115.80)	2.88(7.50)	11.58(114.17)	6.73(55.83)	24.00(545.33)
Guava	3.21(20.00)	5.47(33.3)	9.99(104.20)	1.55(2.04)	10.82(101.67)	4.25(21.67)	16.89(283.33)
CD (P=0.05)	2.25	2.03	NS	0.38	NS	1.24	2.29
Weed management practices(W)							
Pendimethalin @ 1000 g/ha	8.33(108.33)	9.77(78.33)	13.17(150.00)	2.80(6.67)	11.88(120.0)	5.55(28.33)	23.10(491.67)
Imazethapyr @ 125 g/ha	8.04(100.00)	7.89(68.33)	7.60(61.67)	1.00(0.00)	11.84(120.00)	4.49(25.00)	17.95(320.00)
Weedy check	11.29(110.0)	11.15(116.67)	14.69(188.30)	4.07(13.33)	11.55(115.0)	10.39(100.0)	26.08(643.33)
1-Hand weeding (20 DAS)	3.88(16.67)	3.44(13.33)	7.29(40.00)	1.00(0.00)	9.54(76.67)	1.53(1.67)	14.65(203.33)
CD (P=0.05)	1.21	1.32	1.13	0.48	1.80	0.95	2.06
S*W	NS	NS	NS	NS	NS	NS	NS

Data are subjected to square root transformation. Original value given in parenthesis. [a] Data recorded at 40 DAS.

Table 2: Effect of agri-horti system and weed management practices on weed density in mungbean

Treatments	Weed biomass (g/m^2)[a]						
	Cyperus rotundus	*Trianthema monogyna*	*Echinochloa colonum*	*Cynodon dactylon*	*Dactylectium aegyptium*	Miscellaneous weed	Total weed
Agri-horti system(S)							
Custard Apple	3.15(6.12)	3.49(6.67)	3.68(8.25)	1.80(1.78)	3.88(9.23)	2.73(4.41)	6.98(36.50)
Guava	1.63(1.73)	2.11(1.89)	3.09(5.64)	1.00(0.00)	3.61(7.20)	1.54(1.13)	5.00(17.59)
CD (P=0.05)	0.38	0.72	0.63	NS	0.76	0.36	1.40
Weed management practices(W)							
Pendimethalin @ 1000 g/ha	2.27(4.38)	2.96(4.40)	3.87(8.47)	2.29(3.33)	3.69(7.40)	1.85(1.53)	6.33(29.53)
Imazethapyr @ 125 g/ha	1.84(1.78)	2.82(4.33)	3.08(4.63)	1.00(0.00)	4.34(11.2)	1.82(1.37)	5.73(23.35)
Weedy check	3.60(7.20)	3.39(6.00)	4.27(10.90)	1.24(0.18)	3.85(8.40)	3.24(7.55)	7.76(40.17)
1-Hand weeding (20 DAS)	1.84(2.32)	2.03(2.50)	2.31(3.78)	1.00(0.00)	3.11(5.87)	1.62(0.63)	4.62(15.13)
CD (P=0.05)	0.44	0.72	0.79	0.21	0.59	0.33	0.74
S*W	NS	NS	NS	NS	NS	NS	NS

Data are subjected to square root transformation. Original value given in parenthesis. [a] Data recorded at 40 DAS.

Table 3: Effect of agri-horti system and weed management practices on growth, yield attributes and yield of mungbean

Treatments	Plant Growth				Yield Attributes and Yield			
	Plant height (cm)	Dry Matter Accumulation (g/m^2)	Green trifoliate count(No./plant)	Branch count(No. /plant)	Grains count (No. /pod)	1000-grain weight(g)	Grain yield (kg/ha)	Harvest index
Agri-horti system(S)								
Custard Apple	28.79	928.53	5.22	3.50	9.73	30.86	701.13	25.70
Guava	31.63	1062.50	5.43	3.85	9.84	34.31	726.31	25.75
CD (P=0.05)	NS	NS	NS	NS	NS	3.09	NS	NS
Weed management practices(W)								
Pendimethalin @ 1000 g/ha	29.27	891.94	5.00	3.50	9.60	32.27	765.30	25.75
Imazethapyr @ 125 g/ha	30.63	1141.83	5.17	3.83	9.98	32.50	788.36	26.13
Weedy check	27.43	605.94	4.87	3.17	9.52	31.20	418.79	23.85
1-Hand weeding (20 DAS)	33.51	1342.33	6.27	4.17	10.05	34.37	883.23	27.17
CD (P=0.05)	3.77	132.35	0.83	0.69	NS	1.01	53.49	1.23
S*W	NS	NS	NS	NS	NS	NS	NS	NS

et al., 1990; Zimdahl 2007) and less volatile (Zimdahl 2007) as compared to pendimethalin, (3)rainfall occurs within 12 hr of pendimethalin application; increased moisture levels leads to faster degradation of pendimethalin (Savage and Jordan,1980; Zimdahl *et al.*, 1984). Savage and Jordan (1980) reported that if rainfall occurs on the first day of pendimethalin application it reduced its content by 33 per cent after 3 days, as compared to the same treatment exposed to sunlight, receiving no rainfall.

Both applied herbicides showed at par density and biomass of *Cyperus rotundus* because by nature both the herbicides chemically not suited for management of sedges. Imazethapyr 125 g/ha and 1-hand weeding recorded at par density and biomass of *Cynodon dactylon* and biomass of *Echinochloa colonum*.

Effect on Crop Growth

Agri-horti system

Agri-horti system have no significant effect on growth and yield of mungbean (Table 3) this may be due to both the plantation having same age *i.e.* 5-years old and all of their growth parameters *viz.* plant height, number of branches, canopy diameter, crown length and girth are very much similar to one another (data not shown), thus crop grown under both the canopy faces similar micro-climate thereby exhibit no significant difference.

Weed management practices

Imazethapyr 125 g/ha and 1-hand weeding recorded at par highest mungbean plant height and number of branches/plant (Table 3). Application of 1-hand weeding showed significantly highest crop dry matter accumulation followed by imazethapyr 125 g/ha. Grain count did not differed significantly with weed management practices. Application of 1-hand weeding produced highest 1000-grain weight, grain yield and harvest index (HI), though HI was at par to imazethapyr 125g/ha. Higher grain yield under 1-hand weeding was attributed to less weed density and weed biomass (Table 1 and 2) resulting into better utilization of natural resources by crop and in turn higher yield attributes and yield of mungbean. Similarly, Rao and Rao (2006) observed higher black gram grain yield under 1-hand weeding (25 DAS).

REFERENCES

Bayan, H. C. and Gogoi, S. 1998. Influence of weed control measures and phosphorus levels on weed growth, yield and yield attributes of *kharif* blackgram (*Phaseolus mungo* L.). *Ann. Agr Res.* **3(2):** 167-171.

Brown, R. L., Tang, C. S. and Nishimoto, R. K. 1983. Growth inhibition from guava root exudates. *HortScience*. **18:** 316-318.

Goetz, A. J., Lavy, T. L., Edward, E. and Gbur, Jr. 1990. Degradation and field persistence of imazethapyr. *Weed Sci.* **38:** 421-428.

Gomez, K. A. and Gomez, A. A. 1984. Statitical Procedures in Agriculture Research, Wiley 2nd Edition, New York, Chichester.

Krämer, W. and Schirmer, U. 2007. Modern Crop Protection Compounds. *Wiley-VCH Verlag GmbH and Co. KGaA, Weinheim.*

Muthiah, A. R. 2004. Opportunities for the cultivation of extra short duration mungbean in Tamil Nadu, India. Agronomic management of mungbean grown under different environments. In Proc. of Final workshop and planning meeting of 'Improving income and nutrition by incorporating mungbean in cereal fallows in the Indo-Gangetic plains of south Asia DFID Mung beanProject for 2002-2004' (Shanmugasundaram S ed.) held at Punjab Agricultural University, Ludhiana, 27-31 May, 2004. pp 183-188.

Naeem, M., Ali, H. and Ahmad, S. 1999. Effect of pre-plant and pre-emergence herbicides on weed growth and nodulation of mungbean. *Pak. J. Biol. Sci.* **2(4):** 1598-1600.

Poehlman, J. M. 1991. The mungbean culture. West View Press San Franciesco ,Oxford. pp. 121-122.

Raman, R. 2006. Impact of weed management practices on the growth and yield of mungbean (*Vigna radiata* L. Happer) *Crop Res.* **32(1):** 24-26.

Rao, A. S. and Rao, R. S. N. 2006. Effect of stage and doses of cyhalofop-butyl on *Echinochloa colona* control in blackgram grown as paira crop. *Ind. J. Weed Sci.* **38(1&2):** 148-149.

Rizvi, S. J. H., Mukerji, D. and Mathur, S. N. 1980. A new report on a possible source of natural herbicide. *Indian J. Exp. Biol.***18:** 77-78.

Rizvi, S. J. H., Tahir, M., Rizvi, V., Kohli, R. K. and Ansari, A. 1999. Allelopathic Interactions in Agroforestry Systems. *Crit. Rev. Plant Sci.* **18(6):** 773-796.

Savage, K. E. and Jordan, T. N. 1980. Persistence of three dinitroaniline herbicides on the soil surface. *Weed Sci.* **28(1):** 105-110.

Sekhon, H. S., Singh, G., Sharma, P. and Sharma, P. 2004. Agronomic management of mungbean grown under different environments. In: Proc. of Final workshop and planning meeting of 'Improving income and nutrition by incorporating Mungbean in cereal fallows in the Indo-Gangetic plains of south Asia DFID Mungbean Project for 2002-

2004' (Shanmugasundaram S ed.) held at Punjab Agricultural University, Ludhiana, May, 2004. pp. 27-31

Shaner, D. L. and Tecle, B. 2001. Designing herbicide tolerance based on metabolic alteration: The challenges and the future. In: Pesticide Biotransformation in Plants and Microorganisms, Hall, J. C., Hoagland, R. E., Zablotowicz, R. M. (Eds.). *ACS Symposium Series 777, American Chemical Society, Washington, DC.*

Singh, G., Ram, I. C. and Singh, D. 1991. Crop weeds competition in green gram. *Trop. Pest Manage.* **37(2):** 144-148.

Singh, M. K., Saini, S. S. 2008. Planting date, mulch, and herbicide rate effects on the growth, yield, and physicochemical properties of menthol mint (*Mentha arvensis* L.). *Weed Tech.* **22:** 691-698.

Singh, P. and Kumar, R. 2008. Agro-economics feasibility of weed management in soybean (*Glycine max* L.) grown in vertisols of south-eastern Rajasthan. *Ind. J. Weed Sci.* **40(1&2):** 62-64.

Srinivasarao, C., Singh, R. N., Ganeshamurthy, A. N., Singh, G. and Ali, M. 2007. Fixation and recovery of added phosphorus and potassium in different soil types of pulse-growing regions of India. *Commun. Soil Sci. Plant Anal.* **38:** 449-460.

Tripathi, P. K., Singh, M. K., Singh, J. P. and Singh, O. N. 2012. Effect of rhizobial strains and sulphur nutrition on mungbean (*Vigna radiata* (l.) wilczek) cultivars under dryland agro-ecosystem of Indo-Gangetic plain. *Afr. J. Agric. Res.* **7(1):** 34-42.

Zimdahl, R. L. 2007. Fundamentals of weed science. Elsevier, U.S.A.

Zimdahl, R. L., Catizone, P. and Butcher, C. 1984. Degradation of pendimethalin in soil. *Weed Sci.* **32(3):** 408-412.