Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; SP1: 3258-3260

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Effect of diversification and intensification of rice-wheat cropping system on weed dynamics in different vegetable based crop sequences in Nalanda District of South Bihar

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Abstract

An experiment was conducted at Nalanda College of Horticulture, Noorsarai, Nalanda during three consecutive years of 2012-13, 2013-14 and 2014-2015 to study weed flora and dynamics in different crop sequences. The experiment was laid down in Randomized Block Design with three replications. There were eight crop sequences have been taken for study. Weed flora of different crops in all three seasons have been counted (m^{-2}). Various observations were recorded on pattern of weed infestation in various crops under different cropping systems at 25 days after sowing/planting. Among all the crop sequences, maize-potato-onion reported highest number of weed population (636 m^{-2}) followed by okra-cauliflower-sponge gourd (599 m^{-2}) and onion-onion-bottle gourd (583 m^{-2}) during first year of investigation. But, in third year, the maize-potato-onion recorded (437), followed by okra-cauliflower-sponge gourd (397 m^{-2}) and onion-onion-bottle gourd (293 m^{-2}). Among weeds *Cyperus rotundus* was reported major in all crop sequences in all three seasons followed by *Coronopus didymus* in rabi and *Phyllanthus Eclipta* and *Amaranthus* in *Kharif* and *Zaid* season. It is concluded that *Cyperus rotundus,* being perennial is major dominant weed in all the crop sequences, while, *Coronopus, Phyllanthus, Eclipta* and *Amaranthus* spp. being annuals can be reduced by growing crop sequences *viz.,* onion-onion-bottlegourd, okra-cauliflower-sponge gourd and okra-cabbage-bottle gourd by inter culture operations.

Keywords: Diversification, Intensification, Relative weed density.

Introduction

Agronomic research contributed to the tremendous increase in agricultural production and India has made impressive strides on the agricultural front during the last six decades. The food grain production increased by more than 5 times from a meagre 50.8 million tonnes in 1950-51 to 265 million tonnes in 2013-14. Virtually, this increase in the food grain production resulted from yield gains rather than expansion of cultivated area. Despite advances in control technologies, weeds have retained their rank as the most damaging of crop pests because weed communities continue to adapt in response to new management measures (Sosnoski and Cardina, 2006) [12]. Among biotic stresses, crop losses due to weed competition throughout the world as a whole, are greater than those resulting from combined effect of insect-pests and diseases (Hassan *et al.*, 2005) [8]. Besides causing crop losses, weeds creating competition for nutrients, space, and water etc. and reduce the crop yield and the quality of produce (Arif *et al.*, 2006) [1] and also harbor pests (nematodes, insects, pathogens) of the crop reducing potential yields and quality further (Boydston *et al*. 2008) [3]. Crop losses due to weeds vary by crop, weed species, location, and farming system (Bridges 1992; Swinton *et al*. 1994) [4, 16]. These weeds if managed timely, has a potential of substantial increase in the production of food grains. In some situations the uncontrolled weeds can even lead to complete crop failure and is an important constraint of yield reduction in most crops across the world. Serious problems with herbicides are very fast development of herbicides resistance, results high cost, and triggers the development of new techniques in weed management. The most common traits of a weed species is its tendency to be an annual or biennial rather than a perennial; this allows the species a faster reproduction rate leading to a higher fecundity (Sutherland, 2004) [15]. Other characteristics that determine the 'weediness' of a species is the ability to colonize under high sunlight and low soil moisture conditions. Herbicide is a key component in almost all weed management strategies, but the indiscriminate use of herbicides has resulted in serious ecological and environmental problems. Thus, a very serious need felt to study the weed flora and their dominancy by which an agronomic manipulation can be adopted for weed management which are environmentally safe. Dynamics of weed populations in arable fields are influenced by environmental and soil characteristics and also by cropping system and management practise (Koocheki *et al.*, 2009) [9]. Manipulation of cropping system require better understanding of the spatial and temporal weed dynamics and influences of crop and soil-related factors on weed life cycles (Davis and Liebman, 2003) [5]. Weed flora have changed over the past century, with either increasing or decreasing species abundance depending on the management (Bagmet, 2000; Marshall *et al*., 2003; Stoate *et al*., 2002) [2, 11, 14]. Hence, this study was conducted for knowledge of weed flora and dynamics in different crop sequences.

Materials and Methods

This experiment was conducted at Nalanda College of Horticulture, Noorsarai, Nalanda during three consecutive years of 2012-13, 2013-14 and 2014-2015. The soil of the experimental plot was clay loam with 7.45 pH and 0.61% organic carbon, 258 kg, 14.45 kg and 138 kg ha^{-1} available N, P and K respectively. The experiment was laid down in Randomized Block Design with three replications. There were eight crop sequences *viz.*, (1)-Rice-Wheat (Existing cropping system), (2)-Maize-Potato-Onion, (3)-Okra-Potato-Okra, (4)-Okra-Cabbage-Bottlegourd, (5)-Okra-Cauliflower-Spongegourd, (6)-Onion-Onion-Bottle gourd, (7)-Okra-Tomato-Cowpea and (8)-Okra-Brinjal-Cowpea have been taken for study. Recommended package of practices for all the crops in system were followed. Weed flora of different crops in all three seasons have been counted (m^{-2}). Various observations were recorded on pattern of weed infestation in various crops under different cropping systems at 25days after sowing/planting. Weeds were controlled in rice and wheat by hand weeding at 30 days after planting/sowing and in potato, by hand weeding followed by earthing at 30 days after sowing. After this, weed dynamics of all cropping systems were worked out.

Results & Discussion

Among all the crop sequences, maize-potato-onion reported highest number of weed population (636 m^{-2}) followed by okra-cauliflower-sponge gourd (599 m^{-2}) and onion-onion-bottle gourd (583 m^{-2}) during first year of investigation (Table 1). But, when years passed, these respective crop sequences found reduction in number of weed population. In third year, the maize-potato-onion recorded (437), followed by okra-cauliflower-sponge gourd (397 m^{-2}) and onion-onion-bottle gourd (293 m^{-2}). Reduction in weed numbers in these crop sequences may be due to inter culture operations that performed at critical period of crop growth stages that reduces further seed formation and propagating materials. Tillage operations can have a major impact on the distribution of the weed flora, weed seeds and propagules in soil, because soil disturbance regimes are related to seed distribution and viability (Lutman *et al*., 2002) [10], seed emergence (Grundy *et al*., 1999) [7], like tubers and rhizomes etc. Among all kind of weed, *Cyperus rotundus* was reported major in all the three seasons in all the crop sequences (Table 2). During first year of study, the average relative weed density (RWD) of *Cyperus rotundus* was 47.17% in maize-potato-onion, 37.5% in okra-cauliflower-sponge gourd and 46.06 % in onion-onion-bottlegourd. While in rabi, after *Cyperus rotundus*, *Coronopus didymus* observed major weed in all the crop sequences. The highest population of *Coronopus didymus* was reported (36.1%) in rice-wheat, (27.1%) in maize-potato-onion and (22%) in okra-tomato-cowpea, while lowest was reported in onion-onion-bottle gourd (14.7%). Likewise, in summer also, *Cyperus* reported major weed in all the crop sequences followed by *Phyllanthus niruri*, (19.2%) in okra-cauliflower-sponge gourd followed by (13.8%) in rice-wheat and (13.2%) in okra-tomato-cowpea. In third year of study, the average relative weed density (RWD) of *Cyperus rotundus* was found reduced to 37.55% in maize-potato-onion but reported more in okra-cauliflower-sponge gourd (52.42) and onion-onion-bottle gourd (56.7). While, the RWD of major annuals *Coronopus didymus* in rabi was found (37.63%) in rice-wheat as major crop associated weed of wheat followed by (20.0%) in maize-potato-onion, (18.41%) in okra-potato-okra, (17.07%) in okra-tomato-cowpea. While, lowest was reported (4.55%) in onion-onion-bottle gourd followed by (7.21%) in okra-cauliflower-sponge gourd. Similarly, the highest RWD of *Phyllanthus niruri*, was found (22.09%) in rice-wheat followed by (10.61%) in maize-potato-onion, (13.21%) in okra-potato-okra, While, lowest was reported (4.31%) in onion-onion-bottle gourd followed by (4.95%) in okra-cauliflower-sponge gourd. Agricultural practices change the population and composition of weeds and the soil seed bank in agro-ecosystems; although most weed management systems do not consider the impact on weed population dynamics (Davis *et al*., 2004) [6]. Changes in crop rotation and herbicide use could change the weed seed banks in arable soils (Squire *et al*., 2000) [13]. On the basis of the above study it is concluded that *Cyperus rotundus* being perennial is major weed in all the crop sequences, while, *Coronopus*, *Phyllanthus*, *Eclipta* and *Amaranthus* spp. being annuals can be reduced by growing crop sequences *viz.*, onion-onion-bottlegourd, okra-cauliflower-sponge gourd and okra-cabbage-bottle gourd by inter culture operations.

Table 1: No. of weed flora of different crop sequences in three different (*Kharif*, *Rabi* and *Zaid*) seasons at 25 day after sowing/planting

Treatments	First year (2012-13)				Second year (2013-14)				Third year (2014-15)			
	(K)	(R)	(Z)	Total	(K)	(R)	(Z)	Total	(K)	(R)	(Z)	Total
Rice-Wheat	232	208	-	440	235	222	-	457	249	194	-	443
Maize-Potato-Onion	279	177	180	636	209	105	123	494	198	145	151	437
Okra-Potato-Okra	198	108	134	500	162	151	131	444	212	201	157	570
Okra-Cabbage-Bottle gourd	205	130	167	502	186	119	123	428	188	92	130	410
Okra-Cauliflower-Sponge gourd	211	173	215	599	224	159	185	568	192	111	96	397
Onion-Onion-Bottle gourd	178	191	214	583	119	142	151	413	66	88	139	293
Okra-Tomato-Cowpea	191	159	162	512	214	140	137	491	204	123	113	440
Okra-Brinjal-Cowpea	209	136	86	431	234	143	120	497	173	105	75	353

(K): Kharif, R:Rabi, Z: Zaid

Table 2: Relative weed density (RWD %) of major weed flora in different crop sequences at 25 day after sowing/planting

Treatments	Relative Weed Density (%)								
	****Cyperus rotundus***			***Coronopus didymus* (Rabi season)**			****Phyllanthus niruri***		
	1st year	**2nd year**	**3rd year**	**1st year**	**2nd year**	**3rd year**	**1st year**	**2nd year**	**3rd year**
Rice-Wheat	32.15	31.37	30.99	36.1	31.08	37.63	13.8	13.19	22.09
Maize-Potato-Onion	47.16	40.26	37.55	27.1	19.09	20.0	12.2	8.05	10.61
Okra-Potato-Okra	33.03	33.87	34.54	19.0	14.57	18.41	10.15	9.26	13.21
Okra-Cabbage-Bottle gourd	38.23	38.20	54.83	16.2	19.78	13.04	9.6	9.16	9.08
Okra-Cauliflower-Sponge gourd	37.5	34.93	52.42	16.8	22.01	7.21	19.2	21.56	4.95
Onion-Onion-Bottle gourd	46.06	53.66	56.7	14.7	6.9	4.55	12.6	14.70	4.31
Okra-Tomato-Cowpea	39.2	41.87	46.51	22.0	17.86	17.07	13.2	20.02	9.42
Okra-Brinjal-Cowpea	36.0	42.96	53.31	20.6	19.58	9.52	11.3	12.15	10.6

*Average relative weed density of three respective crop season; *Kharif Rabi* and Summer
** Average relative weed density of *Kharif* and Summer

References

1. Arif M, Khan M, Akbar H, Sajjad, Ali S. Prospect of wheat as dual purpose crop and its impact on weeds. Pakistan J Weed Sci. Res. 2006; 12(2):13-17
2. Bagmet L. Dynamic of the segetal element of weed flora in the Lower-Volga region, Z. Pflanzenk. Pflanzen 2000; 17:85-90.
3. Boydston RA, Mojtahedi H, Crosslin JM, Brown CR, Anderson T. Effect of hairy nightshade (*Solanum sarrachoides*) presence on potato nematodes, diseases, and insect pests. Weed Sci 2008; 56:151-154
4. Bridges DC. Crop losses due to weeds in the United States. Weed Science Society of America, Champaign, 1992.
5. Davis AS, Liebman M. Cropping system effects on giant foxtail (*Setaria faberi*) demography: I. Green manure and Tillage timing, Weed Sci. 2003; 51:919-929.
6. Davis AS, Dixon PM, Liebman M. Using matrix models to determine cropping system effects on annual weed demography, Ecol. Appl. 2004; 14:655-668.
7. Grundy AC, Mead A, Burston S. Modelling the effect of cultivation on seed movement with application to the prediction of weed seedling emergence, Journal of Applied Ecology. 1999; 36:663-678.
8. Hassan I, Hussain Z, Akbar G. Effect of permanent raised beds on water productivity for irrigated maize–wheat cropping system. In: Roth CH *et al*. ed: Evaluation and Performance of Permanent Raised Bed Cropping Systems in Asia, Australia and Mexico, ACIAR, Griffith, Australia. 2005; 121:59-65.
9. Koocheki A, Nassiri M, Alimoradi L, Ghorbani R. Effect of cropping system and crop rotations on weeds. Agronomy for Sustainable Development. 2009; 29(2):401-408
10. Lutman PJW, Cussans GW, Wright KJ, Wilson BJ, Wright G Mc N, Lawson HM. The persistence of seeds of 16 weeds species over six years in two arable fields, Weed Research 2002; 42:231-241.
11. Marshall EJP, Brown VK, Boatman ND, Lutman PJW, Squire GR, Ward LK. The role of weeds in supporting biological diversity within crop fields, *Weed Res*. 2003; 43:77-89.
12. Sosnoski LM, Cardina J. Weed seed bank community composition in a 35-yr-old tillage and rotation experiment, *Weed Sci*. 2006; 54:263-273.
13. Squire GR, Rodgers S, Wright G. Community-scale seed bank response to less intense rotation and reduced herbicide input at three sites, Ann. Appl. Biol. 2000; 136:47-57.
14. Stoate C, Boatman D, Borralho RJ, Carvalho CR, Desnoo GR, Eden P. Ecological impacts of arable intensification in Europe. J Environ. Manage. 2002; 63:337-365.
15. Sutherland S. What Makes a Weed a Weed: Life History Traits of Native and Exotic Plants in the USA. *Oecologia*, 2004; 141:24-39
16. Swinton SM, Buhler DD, Forecella F, Gunsolus JL, King RP. Estimation of crop yield loss due to interference by multiple weed species. Weed Sci 1994; 42:103-109.