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Quantitative Determination of Weed Occurrence on Upland Rice of Bambasi, Ethiopia

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Abstract: The weed survey was carried out in 2012 and 2013 cropping season on eight to ten upland rice farmers' fields respectively in Bambasi, Ethiopia to determine weed prevalence, species composition and distribution. A quadrant size of 0.25 m^2 were used in a systematic sampling technique and a total of 21 weed species belonging to 12 families were identified and counted. The most dominant weed family based on the number of species recorded was poaceae (grasses) which comprized 5 species. during both cropping season survey, most (66.67 %) of the species were broad leaved herbaceous plant. weed species composition was analyzed using quantitative means and most frequent weed species in upland rice field during 2012 cropping season was cyprus rotondus (100%) followed by *Ageranthum conizoid*, *Commelina subulata*, *Digitaria abisynica*, *Elusin indica* and *Leucas martinicensis*. The dominance range during this year was 0.09 to 54.59% and *Ageranthum conizoid* accounted 54.59% of the species which was followed by *Cyprus rotondus*, *Spergula arvensis* and *Commelina subulata*. during 2013 cropping season *Ageranthum conizoid* and *Polygonum nepalense* were the most frequently (100%) occurred weed species followed by *Cyprus rotondus*, *Commelina subulata*, *Digitaria scalarum*, *Elusina indica*, *Galensoga parviflora*. The dominant weed species during this year (2013) was *Polygonum nepalense* (20%) followed by A*geranthum conizoid* and *Cyprus rotondus*, *Commelina subulata* and *Leucas martinicensis* dominance level range between 16.36% and 4.02% respectively. The prevalence and density of most species on upland rice during 2012 and 2013 cropping season was similar. Moreover, similarity index between the 2012 and 2013 surveys were higher (100%). Thus, the weed control and management research strategy should consider the dominant and frequent weed species of both cropping seasons and weed flora composition.

Keywords: Rice, Weed Species Composition, Quantitative

1. Introduction

Rice is the staple food for over half the world's population. It provides 27% of dietary energy and 20% of dietary protein in the developing world [FAO, 2004]. Global production of rice has rizen steadily from around 200 million metric tons (MT) in 1960, to over 678 million MT in 2009. Today, it represents 29% of the total output of grain crops worldwide with cultivation is estimate of 150 million ha. Over 90% of the world's total rice crop is produced in South and East Asia and Africa accounts only 3% of global production (EUCORD, 2012). In Ethiopia, rice cultivation was first started at the Fogera and Gambella plains in the early1970s (Mulugeta and Heluf, 2005). But a wide cultivation of rice in Ethiopia is a recent history and in 2006 area coverage were 18,000 ha with production of 42,000 tons which increased to 496,000 tons in 2009 with the area coverage of 155,000 ha (MoARD, 2010). In Ethiopia the rice crop is used in the preparation of local foods such injera, dabbo, genffo, kinchie and shorba in addition to the rice dish it-self and local beverages like tella and katikalla either alone or mixed with other cereal grains such as teff, millet, wheat, barley, sorghum and maize. Moreover, rice could also be considered as one of the best and cheapest alternative technology available to farmers for efficient utilization of natural resources, such as land and water (Mulgeta and Heluf, 2005). As a result rice production in Benishangul Gumuze is rapidly expanding, land coverage increased from 545.75 ha in 2009

to 1378.775 in 2011 (BGBoARD, 2011). Despite the expansion productivity in the region is 28.6 Q/ha which is far beyond comparing to other part of the world. Among the cause for lower productivity low soil fertility inadequate nutrient management (Mulgeta and Heluf, 2005), weeds, disease and insect pests damages are the major problems.

Weeds are the most underestimated pest in tropical agriculture, but they have influenced human activities more than other crop pests. They are notorious yield reducers that are, in many situations, economically more important than insects, fungi or other pest organisms (Savary et al., 1997). Crop yield losses from weeds are vary from crop to crop and from region to region, as a result of various biotic and abiotic factors and weeds cause an estimated yield loss of 10% in the less developed countries (Akobundu, 1981). In the main rice growing rain fed ecologies weeds are the main constraints, reducing production by 40-80% and potentially causing total crop failure if left uncontrolled (WARDA, 1998). In West Africa, between 27 and 37% of the total labour invested in rice is taken up by weeding (WARDA, 1998). A quantitative determination of weed species is more informative and better recognized and reports characteristics or parameters which can be used to describe a weed community quantitatively. These parameters are frequency or constancy of species, abundance, dominance of the species, and a community index or similarity of species in different crops and/or agro-climatic conditions (Pohlan, 1984).

The weed species in the areas are diversified which include broad-leaved, grass and sedges type weeds. Farmers in the area commonly practice hand-weeding and manual cultivation using hand-hoe to suppress weeds in upland rice which is ineffective to attain the required yield because it doesn't considered the species composition and distribution. In the past there was no effort was mad to identify and develop a weed list of upland rice in Bambasi area. On the other hand for priority setting and development of effective and sustainable weed management strategy a survey and identification of weeds flora is a pre-requisite.

This survey was therefore initiated to generate baseline information of farmers' prior upland rice weed problem and establish a management or control research strategies for the area. In addition, to assist development workers, agricultural experts and other interested organizations in providing information about the weed species composition and distribution in upland rice fields.

2. Material and Methods

The survey was conducted in Bambasi areas of Assosa zone (Benishangul Gumuz Regional State) where most of rice production fields were presented. The area is located 45 km far from Assosa town (Administrative town of the region) at an elevation range of 1300 to 1470 m.a.s.l and a coordinate position range of 10.067° North 34.517° East. The area has an average temperature range of 21oC-35°C and annual rainfall amount of 1350-1450mm.

The survey was conducted based on preliminary assessment of rice production areas and weed distribution on unwedded fields during 2012-2013 cropping season. The important primary and secondary information was also collected by questioning 20 rice growing farmers. The pilot survey was also helped to purposively select eight upland rice production fields in 2012/13 and ten fields in 2013/14 cropping seasons. And the survey was conducted on upland rice field area ranging between 0.5-1.5ha. Individual weed species were thoroughly counted with randomly thrown $0.25m^2$ size quadrant with inverted W technique (Thomas, 1985) at every 7-10 meters. At each field 12-18 sample plots were taken based on field size and species distribution. Individual weed species were identified and listed using field identification guide prepared by Ann S. and Chris P., 1989.

The data was analyzed using the formula of frequency, abundance, dominancy as described by Taye *et al*., 1998.

$$\text{Frequency: } F = X/N \times 100 \quad (1)$$

Where,
F = frequency,
X = number of occurrences of weed species,
N = sample number.

$$\text{Abundance: } A = \Sigma W/N \quad (2)$$

Where,
A = abundance,
W = number of individuals of a weed species,
N = sample number.

$$\text{Dominance: } D = A/\Sigma A \times 100 \quad (3)$$

Where,
D = dominance,
ΣA = total abundance of all species.

$$\text{Similarity Index (SI)} = (Epg)/(Epg + Epa + Epb) \times 100 \quad (4)$$

Where,
SI= similarity index;
Epg = number of weed species found in all year;
Epa = number of species only in year a;
Epb = number of species only in year b.

3. Results and Discussions

The result prevailed that in both 2012 and 2013 cropping seasons, 21 weed species which belong to 12 families were identified. The result on table 1 and 2 indicated that among the identified weed species composition in upland rice fields at Bambasi area, most (66.67 %) of the species was annual, 19.05% perennial and the remaining 14.28% were biennial weeds during both cropping seasons. The survey result also prevailed that upland rice fields were competed mostly (66.67 %) by a broad leaved herbaceous weed species type and also with some 19.05% grass weeds and few (4.76%) sedge typed weed species in both cropping seasons (table 1 and 2).

Table 1. *Weed species composition characteristics and distribution in upland rice during 2012 cropping season.*

Characteristic						
Weed species	**Family**	**Form**	**Type**	**F (%)**	**A**	**D (%)**
Cyprus rotundus L.	Cyperaceae	p	s	100	23.86	14.61
Ageranthum conizoid L.	Asterteraceae	a	h	85.71	89.14	54.59
Commelina subulata Root.	Commelinaceae	a	h	85.71	12.43	7.61
Digitaria abyssinica (A. Rich) Stampf	Poaceae	p	g	71.43	1.43	0.87
Eleusine indica (L.) Gaerttn	Poaceae	a	g	71.43	4.71	2.89
Leucas martinicensis (Jacq.) Ait. f.	Lamiaceae	a	h	71.43	7.00	4.29
Digitaria ternate (A. Rich) Stampf	Poaceae	a	g	57.14	4.00	2.45
Galensoga parviflora Cav.	Asterteraceae	a	h	57.14	3.86	2.36
Spergula arvensis L.	Caryophyallaceae	a	h	57.14	13.00	7.96
Amaranthus hybridus L.	Amaranthacceae	a	h	28.57	0.14	0.09
Commelina bengalensis L.	Commelinaceae	p	h	28.57	0.86	0.52
Avena fatua L.	Poaceae	a	g	14.28	0.14	0.09
Bidens pilossa L.	Asterteraceae	a	h	14.28	0.14	0.09
Celocia argentea L.	Amaranthacceae	a	h	14.28	0.29	0.17
Cleome monophylla L.	Cpparaceae	a	h	14.28	0.43	0.26
Commelina latifolia A. Rich.	Commelinaceae	a	h	14.28	4.71	0.09
Crassocephalem rubens (Jack.) S. Moor	Compositae	a	h	14.28	0.29	0.17
Cynogulusum lanceolathum Forsk	Boraginaceae	p	h	14.28	0.14	0.09
Datura stramorium L.	Sollanaceae	a	h	14.28	0.14	0.09
Plantago lanceolata L.	Plantagginaceae	b	h	14.28	0.14	0.09
Polygonum nepalense Meisn.	Poaceae	a	h	14.28	1.00	0.61

Table 2. *Weed species composition characteristics and distribution in upland rice during 2013 cropping season.*

Characteristics					
Weed species	**Family**	**Form**	**Type**	**F (%)**	**D (%)**
Ageranthum conizoid L.	Asterteraceae	a	h	100	16.36
Polygonum nepalense Meisn.	Poaceae	a	h	100	20.65
Cyprus rotondus L.	Cyperaceae	p	s	85.71	8.57
Commelina subulata Root.	Commelinaceae	a	h	85.71	4.02
Digitaria abisynica (A. Rich) Stampf	Poaceae	p	g	85.71	6.56
Eleusine indica (L.) Gaerttn	Poaceae	a	g	85.71	2.89
Galensoga parviflora Cav.	Asterteraceae	a	h	85.71	11.55
Leucas martinicensis (Jacq.) Ait. f.	Lamiaceae	a	h	57.14	4.11
Digitaria ternate (A. Rich) Stampf	Poaceae	a	g	57.14	3.06
Commelina bengalensis L.	Commelinaceae	p	h	57.14	1.22
Crassocephalem rubens (Jack.) S. Moor	Compositae	a	h	57.14	0.12
Spergula arvensis L.	Caryophyallaceae	a	h	42.86	3.32
Bidens pilossa L.	Asterteraceae	a	h	42.86	1.14
Cleome monophylla L.	Cpparaceae	a	h	42.86	0.52
Commelina latifolia A. Rich.	Commelinaceae	a	h	42.86	1.14
Datura stramorium L.	Sollanaceae	a	h	42.86	0.69
Amaranthus hybridus L.	Amaranthacceae	a	h	28.57	0.35
Avena fatua L.	Poaceae	a	g	28.57	0.18
Plantago lanceolata L.	Plantagginaceae	b	h	28.57	0.26
Celocia argentea L.	Amaranthacceae	a	h	14.28	0.09
Cynogulusum lanceolathum Forsk	Boraginaceae	p	h	14.28	0.35

F= frequency, A= abundance, D= dominance, a= annual, b= biennial, perennial, h=herbaceous, g=grass, s=sedge

As indicated in table 1, during 2012 cropping season: the weed species' frequency ranges between 14.28 % and 100%. Taye *et al.* (1998) determined that frequency of individual weed species greater than 5% are significantly distributed. Therefore, the weed species of the study area were significantly distributed. *Cyprus rotundus* was occurred in all (100%) surveyed upland rice fields which was followed by *Ageranthum conizoid and Commelina subulata.* Weed species including *Digitaria abisynica, Eleusin indica* and *Leucas martinicensis* were also equally (71.83%) occurred succeeding the earlier species. The result (table 1) also prevailed that *Digitaria ternate, Galensoga parviflora, Spergula arvensis and Amaranthus hybridus* weed species were occurred in more >50% the rice fields during 2012 cropping season. In addition, table 1 indicated that *Ageranthum conizoid, Cyprus rotondus, Commelina subulata, Spergula arvensis* were highly populated weed species of upland rice. Concomitant with this dominance ranged from 0.09 to 54.59% and *Ageranthum conizoid* was accounted about 54.59% of the total weed population which was followed by *Cyprus rotundus* (14.61%), *Spergula arvensis* (7.96%) and *Commelina subulata* (7.61%). According to Taye *et al*., (1998) dominancy level less than 0.01% are at low density, therefore most of the weed species

in upland rice at Bambasi were significantly higher in 2012 cropping season. Moreover, in 2012 cropping season, the dominant weed species were frequently occurred and populated than others. Similarly a weed survey on wheat by Taye *et al*. (1998) indicated that there is a positive and significant correlation among frequency, abundance and dominance, i.e., the higher the frequency of weed species, the higher the abundance and dominance and vice versa.

During 2013 cropping season, the weed species composition of rice fields were similar to the 2012. The survey prevailed that all weed species occurred in most of upland rice fields and densely populated. According to the survey result in 2013 (table 2), cropping season *Ageranthum conizoid* occured in all (100 %) surveyed rice fields equally with that of *Polygonum nepalense* (100%). Following the two weed species *Cyprus rotundus*, Commelina *subulata*, *Digitaria abisynica*, *Eleusine indica*, *Galensoga parviflora* were equally occurred in most (85.71 %) of surveyed rice fields. The frequency of *Polygonum nepalense* and *Galensoga parviflora* in 2013 (table 2) were significantly different from 2012 cropping season result (table 2) that both occurred and distributed rarely as compared to the other weed species. The result in table 2 indicated that most weed species occurrence were ranging from 25% to 60% but *Celocia argentea* and *Cynogulusum lanceolathum* were rarely occurred in 2013 cropping seasons as compared with the other identified weed species. In addition, *Polygonum nepalense* was the dominant weed specie which accounteed for 20% of the total population which is different form 2012 cropping season result. In most cases, the frequencies of weed species were similar in both 2012 and 2013 cropping seasons. Moreover, similar with 2012 cropping season *Ageranthum conizoid* and *Cyprus rotundus*, *Commelina subulata* and *Leucas martinicensis* were among the dominant weed species which accounted for 16.36%, 8.57%, 4.11% and 4.02% respectively. The major cause of some differences in frequency and dominancy of weed species between 2012 and 2013 cropping season were distribution of rainfall, previous cropping system and repetition of cultivation. The similarity indices between 2012 and 2013 was 100 % and according to Taye *et al.* (1998) similarity having similar weed community (SI > 60) will similar weed management activity.

4. Conclusion and Recommendation

The surveys conducted during 2012 and 2013 cropping seasons were identified as the dominant weed species in upland rice fields at Bambasi district. The most abundant weed families among the 12 weed families of the study area; based on dominance, frequency and number of weed species, were Poaceae, Asteraceae, Commelinaceae and Cyperaceae. During the two year surveys, there was some variation in frequency and abundance of some weed species but in most cases the result was similar at both cropping seasons. According to farmers in the study area, the causes for variation included: distribution of rainfall, previous cropping system and frequency of cultivation/tillage/ were the major factors. Moreover, weed species composition between 2012 and 2013 cropping seasons were similar (SI=100%). Thus, during development of a weed control and management research strategies for upland rice, the listed weed species family, type and flora composition should be considered.

In the future it is also important to determine the critical weed free period of weed competition, economic threshold levels of major weeds, furthermore, development of economical, environment friendly and sustainable integrated weed management research strategy is crucial for upland rice production expansion at Bambasi area of Benishangul Gumuz Regional State, Ethiopia.

References

[1] Akobundu I O. (1981). Weed control in direct-seeded lowland rice under poor water control conditions. Weed Research: 21: 273–278.

[2] Ann S. and Chris P. (1989). A weed identification guide for Ethiopia. Food andAgricultural Organization, Rome.

[3] Benishangul Gumuz Regional State Beauro of Agriculture and Rural Development (BGBoARD) (2011). Crop production and productivity in BGRS.

[4] European Cooperative for Rural Development (EUCORD) (2012). Rice Sector Development in Eastern Africa, a desk study prepared for the Common Fund for Commodities.

[5] Food and Agriculture Organisation (FAO) (2004). *Rice is life*: FAO. http://www/fao.org/newsroom/en/focus/200436887/indea.html.

[6] Ministry of Agriculture and Rural Development (2010). National Rice Research and Development Strategy of Ethiopia.

[7] The Federal Democratic Republic of Ethiopia, Ministry of Agriculture and Rural Development, Addis Ababa, Ethiopia.

[8] Mulugeta Seyoum and Heluf Gebrekidan (2005). Effects of N and P fertilizers on yield and N uptake of flooded rice grown on Vertisols of Fogera Plain of Ethiopia; *Indian Journal of Fertilizers*. 1(1): 47–51.

[9] Pohlan J. (1984). Arable Farming. 314 Weed Control. Institute of Tropical Agriculture, Plant Production Section, German Democratic Republic.

[10] Savary S, Srivastave RK, Singh HM, Elazegui FA (1997) A characterization of rice pests and quantification of yield losses in the rice-wheat system of India. Crop Protec. 16 (4): 387-398

[11] Taye Tessema, Yohannes Lemma and Belayneh Admasu (1998). Qualitative and quantitative determination of weed occurrence in wheat in west Shewa Zone of Ethiopia; Tenth regional wheat workshop for Eastern, Central and Southern Africa; 1 (1) 160-172.

[12] Thomas AG (1985). Weed survey system used in Saskatchewan for cereals and oilseed crops. Weed Sci. 33: 34-43.