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RESEARCH ARTICLE

SURVEY ON DISTRIBUTION AND IMPORTANCE OF CEREAL CROP WEEDS IN MIDLAND AND LOWLAND OF GUJI ZONE, SOUTHERN OROMIA

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ABSTRACT

A weed survey was carried out during 2014 and 2015 main cropping seasons with in two agro-ecologies (Mid land and Low land) of Guji zone, Southern Oromia, to assess the distribution and importance of cereal crop weeds as well as to investigate the most dominant weed flora in cereal crops. For this survey, data was collected from four agro-ecologically representative districts where two districts were selected from each agro-ecology purposively. From each districts four Peasant associations were selected and totally, 80 fields were assessed during this survey. Collected data was tested using quantitative and descriptive tools. Accordingly, a total of 42 weed taxa belonging to 18 plant families were identified. Among these families, Gramineae, compositae, polygonaceae and Rubiaceae were the most abundant families recorded during the investigation. Snowden Polistachia, Avena fatua, Bromus pectinatus Thunb, Phalaris paradoxa L, Setaria pumila, Digitaria abyssinica, Galansoga Palviflora, Guizotia Scabra, Tagetes minuta L, Bidens pilosa L, Bidense pachloma , Parthinium hystrophorus L., Polygonum Nepalense , Oxygonum sinuatum, Rumex abyssinica , Andropogon Abyssinicus, Lauracaea Cornuta, Galium Sporium were the most frequent species (68%) followed by Snowden Polistachia (51%). Furthermore, most of farmers(90%) in mid and low land districts mentioned Setaria Verticillata (L.)and Setaria Pumila as important weeds which are the most abundant, frequency and dominant weed species of cereal crops. at both Mid land and Low land agro-ecologies of Guji Zone. In general, this study would provide basic information's regarding the situation of cereal crop weeds in different agro ecologies of Guji Zone that could serve as corner stone for future research on weed.

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INTRODUCTION

In Ethiopia, wheat production is majorly hindered by several biotic and a biotic factors. Among biotic factors, weed holds large portions. Weeds is a plant that interfere with the objective and requirements of man, cause great yield loss in cultivated crop by competing for the limited natural resource, including plant nutrient, soil moisture, light, space etc., particularly in areas where continuous monoculture is practiced. In addition to their direct effect on the crop, weed can harbor pathogen, insect pest, rodent and wild animals. Weeds represent one of the greatest limiting factors to efficient crop production as they cause greater economic losses on agricultural lands than all other pests combined (Patil and Jadhav ,2013). Because, it has been estimated that weeds cause a yield loss of about 10% in the less developed countries and 25% in the least developed countries (Akobundu, 1987).

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Thus, weed can affect crop production and significantly reduce crop yield. Even if the amount of yield loss is not clearly estimated, it's observed that loss caused by this pest is likely to be high in most areas of Ethiopia where crops are dominantly grown. Likewise, the problem is very decisive at high land agro-ecologies of the country. This might be due to the occurrence of high rain fall throughout crop growing seasons. In such conditions, conducive environments will be created for the development as well as spreading out of different weed species to compete with the intended crops to be grown. Because, it's difficult and intensive to carry out proper land preparation prior to sowing and its management after sowing. Thus, presence of each weed population in an arable field is usually the result of ecological reactions to previous management practices, soil characteristics of the site and the regional (Salonen, 1993; Andersson & Milberg, 1998). Weed management practices are varying with nature of weeds, time of weed emergence, cropping system etc. Thus, weed identification before adopting management strategies are necessary in particular crops (Himalaya Subedi, 2013). As a result, several weed species are found in different agro-ecological regions of the country.

So, identifying important weed species found in specific locations is very essential. Because, knowledge of the weed community structure is an important component of weed management, and is essential in setting priorities for both weed management and research. In view of this, the present survey was conducted to address the following objectives; (i) to identify agro-ecological distribution of weed species in cereal crops; (i) to assess and identify Cereal weeds dominancy, frequency and abundance. (iii) To assess the influence of some environmental factors and crop management practices on weed species composition and distribution in cereal crops in the study area.

MATERIALS AND METHODS

Description of the Study area: The survey was carried out at two agro-ecologies (mid land and Low lands of Guji Zone, Southern Oromia during 2014/15 main cropping season. Guji zone is located at an altitude of 600-2700 M.sl. with a distance of 604 km from AA to the South. Geographically, the Zone is situated at 05 39’59’’.99 North latitude and 39 ^{0} 00’0’’.00 East longitude and bordered by SNNP in the North, Bale administrative Zone to South East, Somali Regional state in the South and Borena administrative Zone in the West. Guji Zone has structured by thirty rural districts and two urban districts with about 35,454 km^2 land coverage and above 1.6 million populations (Zonal data). About 68% of the Zone climatic condition is characterized as Kola, Weina Dega and Dega. The Zone receives an annual rain fall of 500-1750 mm with a maximum and minimum temperature of 30.5^{o}c &10.5^{o}c respectively. Agriculture holds large portion of the Zone economic sector integrated with others.

Survey Methodology

For this survey, districts were selected using a: Stratified sampling method based on altitudes; low altitude (<1600 m.a.s.l), medium altitude (1600±1900 m.a.s.l), high altitude (>1900 m.a.s.l) a classification commonly used in relation to potential of cereal crop produced in the zone. Accordingly, two districts were selected from each agro-ecology. Thus, Adola & Odo shakiso were selected from mid land districts while Hara Kelo & Liba were selected for low land. From the selected districts four PA's were purposively selected. Then, Cereal crop fields were selected regardless of size, and on the grounds of accessibility (adjacent to road) at every 5km vehicle Speedo meter. In each field, three to five 0.5mx0.5m quadrants were used following an inverted W pattern (Thomas, 1985). Percentage cover (the ground area covered by the vertical projection of above-ground plant parts) was estimated visually for each of the weed species in each quadrant. Weed identification in the field was done based on weed identification guides (Terry & Michieka, 1987; Stroud & Parker, 1989). Data on major environmental factors and crop management practices believed to influence the weed flora in general and cereal crop in particular in each field were collected by observation (soil type, topography, type of crop), measurement (altitude), interviewing farmers (number of ploughings before planting, month of planting, fertilizer use, number of weeding before the survey date) as well as from secondary sources (administrative zone). Altitude, number of ploughings, month of planting, number of weeding and rainfall were quantitative variables and hence measured on an interval scale. Survey date was used as a co variable in the data analysis.

Interviews with farmers: The Farmers were asked 15 questions on weeds and weed control in general on cereal crop in particular. Because answers tended to be relatively consistent within each village, only the farmers whose fields had been surveyed was interviewed.

Data analyses or method of data analyses

The data on weed species were summarized using:

1. Frequency: The number of fields in which a species occurred expressed as

Percentage of the total number of fields surveyed;

2. Abundance: $A = \sum W/N$

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

3. Dominance: $D = A/\sum Ax100$
Where, D = dominance, $\sum A$ = total abundance of all species and
4. Field uniformity: the number of sampling quadrants in which a species Occurred in a field expressed as percentage of the total number of samples.

RESULTS AND DISCUSSION

For this study, four districts which were clustered under two agro-ecologies and a total of sixteen Pa's were addressed. About, 80 fields from all Pa's were assessed during the study (Table1). A total of 42 weed species belonging to seven plant families were recorded from the two agro-ecologies of Guji zone. Among these families, Gramineae was identified as the most dominant weed family (43.86%) followed by *compositae* (33.84) whereas *Rubiaceae (4.79%) & Polygonaceae (4.62%)* were the list abundant weed families *(*Table2*).* However, different weed species were identified at each agro-ecology based on abundance, frequency and uniformity in the field. Tef, maize, wheat and barley are major cereal crops produced in mid land agro-ecology of Guji Zone. However, productions of these crops were significantly hindered by several weed species. During this study, about 17 weed species having dominance range of 0.14-13.3, frequency 24-88, abundance 0.2-19 and field uniformity of 12-51 were identified from Mid land agro-ecology (Table1). Among the identified species *Setaria Pumila, Setaria Verticillata* and *Digitaria abysinica* were showed dominance >10 and >75 frequency (Table1). Particularly, *Setaria Pumila* is a major grass weed species highly affecting cereal crops including tef, wheat and barley at mid land agro-ecology of Guji Zone. Even though, Farmers were undertaking several management practices, it was observed that the weed is not effectively controlled. This could be due to several factors. Systematic nature of some problematic weed species towards any management practices is one of the major problems in controlling weeds in field. Most of the assessed fields in mid land were observed with *Setaria Pumila* and *Setaria Verticillata* weed species devastation. Farmers were also remarked that these weed species were majorly affecting their fields and beyond their control. Some of the observed fields were totally competed by weeds than the intended crops. From this situation, it was suggested that proper land preparation (timely and frequency),

Table 1. Major weed species of cereal crop fields identified from mid and lowland agro-ecology of Guji Zone, during 2015/16 cropping seasons

No	Botanical name	Local name	Family	Frequency	Abundance	Dominancy	Field uniformity	Life form
1	*Setaria pumila*	Asnadabo	Gramineae	88	19	13.3	51	A grass
2	*Setaria verticillata* (L.)P.Beauv.	Asnadabo	Gramineae	77	17	11.9	48	A grass
3	*Sorghum arundianaceum(*Desv.) stapf	-	Gramineae	61	10	7.02	28	A grass
4	*Digitaria abyssinica*	Marga	Gramineae	78	18.3	12.8	47	A grass
5	*Cyperus rotundus* L.	Quni	Cyperaceae	36	8.6	4.77	22	A sedge
6	*Galansoga Palviflora*	Darachesa	Compositae	73	9.73	6.83	41	A broad leaved
7	*Cynodon dactylon* (L.) Pers.	Sardo	Gramineae	71	5.6	3.93	33	A grass
8	*Guzotia scabra (*Vis.)chiov.	Haadaa	Compositae	69	9.7	6.81	35	A broad leaved
9	*Bidens pilosa* L.	Qaqabata	Compositae	79	7.3	5.12	37	A broad leaved
10	*Commelina benghalensis* L.	Banji	Commelinaceae	42	3.5	2.46	11	A broad leaved
11	*Tagetes minuta* L.	Ajoo	Compositae	57	6.45	4.53	27	A broad leaved
12	*Datura stramonium* L.	Banji	Solanaceae	33	3.2	2.24	16	A broad leaved
13	*Nicandra physalodes* scop.	-	Solanaceae	43	0.6	0.421	18	A broad leaved
14	*Galium Sporium*	Ashkit	Rubiaceae	55	13.8	9.68	27	A broad leaved
15	*Erucastrum arabicum* Fisch & Mey	Zero	Cruciferae	47	4.33	3.04	22	A broad leaved
16	*Xanthium spinosum* L	Qoraatti	Compositae	32	5.2	3.65	17	A broad leaved
17	*Xanthium strumarium L.*	Qoraatti	Compositae	24	0.2	0.14	12	A broad leaved

Table 2. Major weed species of cereal crop fields identified from low land agro-ecology of Guji Zone

No.	Botanical name	Local name	Family	Frequency	Abundance	dominancy	Field uniformity	Life Form
1	*Setaria verticillata* (L.)	Migira saree	Gramineae	76	28	20.78	44	A grass
2	*Setaria pumila*	Migira saree	Gramineae	73	14.8	10.98	41	A grass
3	*Amranthus hybridus* L.	Raafuu	amaranthaceae	68	11	8.16	31	A broad leaved
4	*Amaranthus spinosus* L.	Raafuu	amaranthaceae	63	8	5.93	27	A broad leaved
5	*Parthenium hysterophorus* L.	Anemele	Compositae	63	19	14.09	39	A broad leaved
6	*Xanthium spinosum* L	Qoraattii	Asteraceae	56	17.3	12.84	21	A broad leaved
7	*Xanthium strumarium* L.	Qoraattii	Asteraceae	48	13.5	9.65	16	A broad leaved
8	*Commelina latifolia* A.	-	Commelinaceae	31	10.6	7.86	9	A broad leaved
9	*Argemone Mexicana* L.	Qoraatti	Paraveraceae	30	12.56	9.32	12	A broad leaved

NB:A-annula

using weed free planting materials (source of seeds used to control weed movement to unreached fields), absence of scheduled cereal crop rotation with other recommended crops (to inhabit source of the inoculums for the pest), untimely planting that might be creating active season for weed emergence and expansion. In proper management practices (time of undertaking weed management based on the appearance and weed species, methods of weed managements used for different types of weed species et.c) is also another factor observed in most of the fields assessed. In general, absence of effective weed management practices in mid land agro-ecology of Guji Zone is majorly contributed for the occurrence and spreading out of several devastating weed species to the area. Except few farmers, most of them were managing their field manually (hand weeding) due to several reasons. Because, they perceived that use of herbicides in crop production was considered to be cost, negative effect both on environment and animals, even grain produced by herbicide is harmful to feed.

So, in order to improve the production and productivity of cereal crops at mid land agro-ecology of Guji Zone, weed management practices need great attention by concerned staff towards bringing attitudinal change to farmers on using recommended herbicides as well as supplying the herbicides as required. Like that of mid land, tef, maize and wheat are major cereal crops produced at low land. Weed is a major pest affecting the production of these crops. From the survey collected data, about 17 weed species having dominance range of 5.93-20.78, frequency 30-76, abundance 8-28 and field uniformity of 9-44 were identified from low land agro-ecology (Table2). Among the identified species, *Setaria Verticillata* was the dominant weed species at low land (20.78) followed by *Parthenium hysterophorus* L. (14.84), *Xanthium spinosum* L. (12.84) and *Xanthium strumarium* L. (Table4). Despite the fact that some weeds, such as *Argemone mexicana* and *Xanthium spinosum*, had low frequency they were considered to be problematic weeds by farmers. Thus, high frequency does not indicate the economic or sociological importance of a weed species, as some weeds have other uses, such as feed for livestock, which can be especially important in the lowlands.

Conclusion

In crop production, weed management holds large portion. Particularly, cereal crops are majorly competent with different weed species. In order to provide effective weed management options to the producers, identification of the most problematic weed species in particular area is an important scheme for any intervention to be planned with regard to weed management. As a result, this study also conducted to identify the most problematic cereal weeds found at different agro-ecologies of Guji Zone using different quantitative parameters and factors contributing for their occurrence. Through this survey study, the most abundant and troublesome weed species found in small scale farms of different agro-ecologies of Guji Zone were ranked. The differences were observed between soils, crop types and between locations in weed flora composition, in terms of frequency, abundance and dominance in the mid land and low land agro-ecologies. Accordingly, Setaria verticillata (L.) and Setaria pumila were identified as the most dominant weed species from mid land agro ecology where as Setaria Verticillata, Xanthium strumarium L., Parthenium hysterophorus L. and Xanthium spinosum L were identified as dominant weed species from low land agro-ecology of Guji zone. Poor land preparation(time and frequency), use of poor quality seeds, absence of crop rotation, lack of awareness on importance of weed management using recommended herbicides, method of sowing (broadcasting), in accessibility and incompatibility price of herbicides were identified as major factors contributing for the occurrence and spreading of weed species throughout the study area. Therefore, this study has provided preliminary information's regarding importance and weeds taxonomy of Guji Zone and would serve as base

line for any research as well as strategies to be implemented towards weed management options.

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