Advances in Crop Science and Technology
ISSN: 2329-8863
Research Article Open Access

Survey and Identification of Weed Flora from Major Crops at Borana and West Guji Zones, Southern Ethiopia

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Abstract

The assessment of weed flora was conducted at two zones of southern Oromia in 2020-2022 production years. From each zones the districts were selected purposively based on potential of crop they produce. Identification of the major crop weeds that causes huge damage on production in proper way for a given situation is essential for collecting further information about the weeds pests as well as for developing necessary management measures. on the other hand, wrong identification of the target species of weed in the native habitat may lead to the introduction of the wrong management options, which may also fail reduce the pests. The result showed a total of about 19 weed species under 8 families in common bean, 21 species of weed under 8 families in maize, and twenty-one weed species under seven families were identified in Teff fields. Weed families identified from the surveyed areas includes Asteraceae, Commelinaceae, Compositeae, Cyperaceae, Papaveraceae, Poaceace and Solanaceae. Among the identified weed species Asteraceae and Poaceace were the most dominant weed families when compare to the other families of weeds. Consequently, weed species composition varied among each district. However, in some districts there is alike similar index, in such districts the management options applied should be analogous. In general, among the identified weed species, broadleaf and grass species have greater proportions.

Keywords: Abundance of weed; Frequency; Major crops; Weed flora; Similarity index.

Introduction

Weeds are plants that interfere with the objectives and requirements of man (Steven, 1984). Weeds are genetically diverse and can readily take advantage of the variety of conditions created by any give crop production system. This is primarily due to their ability to produce a large quantity of viable seeds (if it is an annual) or vegetative tissues such as rhizomes (if it is a perennial) in a single growing season Weed serve as alternate and alternative for pest organisms that adversely affect crop production system [1]. The degree of yield loss due to weeds crop depends on the species' competitive ability, relative growth height, time of emergence (relative to the crop), leaf area, vegetative mass and density. In Ethiopia during 2020/21 production year major crops such as Teff, wheat, maize and common bean were cultivated over the area of production 2.93million hectares, 1.9million hectares, 2.53million hectares, 0.21million hectares, and 0.1million hectares respectively. At a time, the production gained from those areas were 1.882tones per hectare, 3.05tones per hectare, 4.18tones per hectare, 1.796tones per hectare, and 1.76tones per hectare respectively. In Borana maize was cultivated over a land of 6,716.82hectares and yields about 891.2089tones which is 1.33tones per hectare and red common bean is cultivated over the land of 5,447.35hectares and results about 577.16tones with average yield 1.10tones per hectare. Similarly in West Guji maize was cultivated over 9,180.49hecares of land and yields about 37880.01tones, with 4.13tones per hectare yields, Red common bean 932.52tones from 5,222.94hectares with 0.18tones per hectare [2]. Despite of its importance, the productivity was very low in compare to the national average yield.

This low yield is attributed to both biotic and abiotic factors. Among biotic factors, Weeds are one of the major limiting factors that can affect crop yield based on their species composition and density, Weeds reduce crop yields by competing for light, nutrients, water and carbon dioxide as well as interfering with harvesting and increasing the cost involved in crop production [3]. The potential areas of Borana and West Guji zones for crop productions includes districts such as Yabello, Teltelle, Elweye, Dire, Abaya and Bule Hora. The past study also confirmed that crop cultivation is firmly expanding in the rangelands and tenure [4, 5]. Though crop production is a relatively on initial level in pastoral concerns, nowadays the urge for crop production knocks the integrity of every household regardless of the production skill and knowledge [6].

According to Mengistu et al., (2020) about 85%, 65% and 30% of the respondents confirmed that they were producing maize, common bean and Teff, respectively. Some internal constraints are lack of agricultural inputs and land competition. According to respondents, the major factors constraining crop production are external and include lack of rainfall (the rainfall pattern is highly erratic and rains often do not occur at the expected time), presence of different harmful agricultural pests, and lack of access to well-functioning markets. The objective of this activity was to know major crops economic weeds and their distribution at Borana and West Guji zones [7].

Materials and Methods

Description of the study area

The weed assessment was conduct at two zones of southern Oromia, Borana and West Guji during 2020-2022 production years [8]. Both zones are located at 570km and 463km from Addis Ababa to the southern part respectively. Their climatic condition is hot with

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Received: 01-Aug-2023, Manuscript No. acst-23-104999; **Editor assigned:** 03-Aug-2023, PreQC No. acst-23-104999 (PQ); **Reviewed:** 19-Aug-2023, QC No. acst-23-104999; **Revised:** 24-Aug-2023, Manuscript No. acst-23-104999 (R); **Published:** 31-Aug-2023, DOI: 10.4172/2329-8863.1000608

Citation: Kitaba K, Nura R, Ejara E, Legesse D (2023) Survey and Identification of Weed Flora from M*ajor Crops at Borana and* West Guji Zones, Southern Ethiopia. Adv Crop Sci Tech 11: 608.

more favorable living entities, but unlike the other districts found in these zones Bule Hora has different agro climatic conditions which tends to mid highland and has a long rainy season than the others. Geographically they fall under an elevation of 1356masl to 1874masl for Borana, and 1422-2328masl for west Guji. Specifically, by districts the altitude range of the surveyed area are as follows Yabello 1490-1800masl, Teltelle 1356-1460masl, Abaya 1422-1460masl and Bule Hora 1860-2328masl [9].

Assessment methods

The survey was done in four districts above listed zones and the districts were selected purposively based on potential of crop they produce. Fields were assessed with the distance of about 3-5KM apart accordingly i.e. based on crop abundance. But, the assessed field for each crop was not equal, for instance for common bean about 113 fields, for maize 94 and for Teff 89 fields were assessed. GPS was used during the assessment for the purpose of geographical data such as elevation, latitude and longitude, distance and area of the survey areas. Also, $1m^2$ quadrat was used during the survey to take sample from the fields and the sampling was done in diagonal pattern in each field. During the survey the producers/farmers were interviewed for source of seed they use, cropping pattern, input used for the crop and sowing date (early or late), presence or absence of the weed in the previous cropping year or season. Weed species compositions frequency (F), abundance (A), dominance (D) and similarity index (SI) were summarized using the formula.

Frequency (constancy): Is the percentage of sampling plots (vegetation registrations) on which a particular weed species is found. It explains as how often a weed species occurs in the survey area. Frequency is calculated for all weed species as follows.

F=100*X/N; Where F= frequency, X=number of weed species occurrences, N= sample number

Similarity index/Community index is the similarity of weed communities between different locations or crop types.

Similarity index=SI = 100*Epg/ (Epg + Epa +Epb)

Where, SI = Similarity index; Epg = number of species found in both locations; Epa = number of species found in location I; Epb = number of species found in locations II

Data analysis

All collected data were feed into computer and managed by using Excel and lastly the data was analyzed using IBM SPSS Statistics 20.

Results and Discussions

The survey of major crops weed flora undergone for the activity shows us, there is a number weed species grown crops and have different abundance percentage over districts as well as the crops.

Major Weed flora recorded from Common bean fields

Total of 113 common bean fields was assessed. About 19 weed flora species with 8 families was identified (Table 1). According to this result some species have high abundance percentage over the other species. Among weed flora recorded weed family of Poacea and Asteraceae are the most dominant and present in high frequency (Table 1).

The assessments result also showed that, among the collected data broad leaf weeds are highly dominant over the grass and sedge type weed species. Among a total of 19 major weed species recorded from common bean fields broad leaf weed species encompasses about 66.67%, while grass and sedge types encompass about 27.78% and 5.56% respectively. Their mean over the all-common bean fields and frequency rate is described in the following (Table 2).

Table 1: Number of weed families identified and number of species they comprise in Common bean fields.

S/N	Weed flora Family	No. of Species
1	Poaceace	4
2	Asteraceae	6
3	Leguminosae	2
4	Commelinaceae	1
5	Composite	2
6	Solanaceae	2
7	Papaveraceae	1
8	Cyperaceae	1
	Total	19

The similarity Index of weed recorded from common bean fields over the districts

As described by Kropff and Spitters (1991), if the similarity index is below 60%, it is said to be that the two locations have different weed communities, for the different location were greater than 60%, it can be concluded that the locations exhibited similar weed community. The similarity index refers to the resemblance of plant/weed species composition of the four districts of two Zones in common bean from which the survey was conducted. The result showed that weed communities of crops grown in Yabello district and Teltalle were related in terms of species composition. As a result, their similarity indexes ranged from 80% and this result directs the obtained similarity index for weeds that grown in common bean is above the standard percentage of similarity index (60%). This shows that the weed grown around these areas have more or less the same categorical properties and for these area similar weed management methods can be applied to manage their effect on the crop production.

The reasons for high similarity value could be attributed to similar environmental factors such as soil properties, tillage operations and weed management practices adopted by the producers, while at Bule Hora & Abaya the calculated weed similarity index indicates there is dissimilarity with other districts, their similarity index value ranged from 15.38 to 42.61 % and below 60%, Table 3 describes more detail of weed species similarity index that grown in common bean over the districts. In contrast to those which have the different similarity index, for management of these districts weed species composition different management method should be used. The difference could be due to weed growth, population density and distribution vary from place to place, geographical arrangements like altitude range, soil type and texture, climatic factors that affect the weed flora, and farmers' management practices, different weed management method can be used to control weed species composition for districts that shown the similarity index greater below 60% (Mekonnen, 2018) (Table 3).

Major Weed flora recorded from maize fields

A total of about twenty-one (21) weed flora species which classified under eight (8) families were identified from maize fields surveyed in four districts of study areas. Among the identified weed families Poaceace and Asteraceae are families with large number of species according to this result (Table 4) i.e., these two families are the most dominant families over the rest families (Table 4).

Table 2: Major weed species Identified in common bean fields.

Botanical Name	Family	Category	Life Cycle	Frequency	Abundance	Dominance
Amaranths hybrids	compositeae	Broad leaf	Annual	13	2.15	9.57
Argemon Mexicana	Papaveraceae	Grass	Annual	6	1.36	6.05
Bidens pilosa L.	Asteraceae	Broad leaf	Annual	9	3.12	13.91
Commelina benghalensis L.	Commelinaceae	Broad leaf	Annual	5	1.14	5.08
Cynodon dactylon (L.) Pers.	Poaceace	Grass	Perennial	18	4.56	20.31
Cyprus esculenta L.	Cyperaceae	Sedge	Perennial	4	1.36	6.05
Datura stramonium L.	Solanaceae	Broad leaf	Annual	4	0.83	3.71
Galinsoga parviflora (Cav.)	Asteraceae	Broad leaf	Annual	2	0.7	3.13
Guizotia scabra	composite	Broad leaf	Annual	1	0.09	0.39
Nicandra physalodes (L.) Gaertn.	Solanaceae	Broad leaf	Annual	3	0.22	0.98
Parthnium hysterophus	Asteraceae	Broad leaf	Annual	2	0.18	0.78

Table 3: Similarity index of weed species composition of common bean over district.

Districts	Abaya	Bule Hora	Taltalle	Yaballo
Abaya	100	28.57	38.46	42,.61
Bule Hora		100	15.38	34.78
Teltalle			100	80

Table 4: Number of weed families identified and number of species they comprise maize fields.

S/N	Weed flora Family	No. of Species
1	Compossiteae	2
2	Papaveraceae	1
3	Asteraceae	6
4	Commelinaceae	1
5	Poaceace	6
6	Cyperaceae	1
7	Solanaceae	3
8	Leguminosae	1
	Total	21

The result of this assessment also showed that, broad leaf weed species are the most dominant over grass and sedge weed species Table 5. Among a total of 21 weed species of maize field's broad leaf weeds accounts about 52.17% of the total weed species identified, while grass types and sedge types hold about 34.78% and 13.04% respectively out of the total (Table 5).

The similarity Index of weed recorded from maize fields over the districts

The Similarity Index result of the weed species recorded from maize field across the districts indicates Yaballo and Teltalle districts have similar weed species similarity index ranged from 72.22%-80, in terms of species composition than at mid land agro-climatic condition of Bule Hora &Abaya districts (Table 6). The other reasons could be similar soil properties, tillage operations and weed management practices adopted [10]. Therefore, for these districts in area where maize is cultivated similar management methods can be designed to overcome the effect of weed on maize production. At mid land agro-

Table 5: Major weed species identified in maize fields.

Botanical Name	Family	Category	Life Cycle	Frequency	Abundance (%)	Dominance (%)
Amaranths hybrids	Compositeae	Broad leaf	Annual	24	2.13	10.67
Argemon Mexicana	Papaveraceae	Grass	Annual	3	0.56	2.83
Avena fatua	Poaceaceae	Grass	Annual	7	1.17	5.87
Bidens pilosa L.	Asteraceae		Annual	10	1.07	5.38
Commelina benghalensis L.	Commelinaceae	Broad leaf	Annual	11	1.5	7.54
Cynodon dactylon (L.) Pers.	Poaceaceae	Grass	Perennial	9	0.85	4.25
Cyprus esculenta L.	Cyperaceae	Sedge	Perennial	3	0.25	1.23
Datura stramonium L.	Solanaceae	Broad leaf	Annual	11	1.07	5.35
Galinsoga parviflora (Cav.)	Asteraceae	Broad leaf	Annual	7	1.07	5.35
Guizotia scabra	composite	Broad leaf	Annual	4	0.08	0.41
Nicandra physalodes (L.) Gaertn.	Solanaceae	Broad leaf	Annual	5	0.73	3.68
Other grass species	Poaceaceae	Grass	Annual	8	1.01	5.07
Poe annual	Poaceaceae	Grass	Annual	1	0.08	0.41
Parthnium hysterophus	Asteraceae	Broad leaf	Annual	26	3.01	15.09
Phalaris paradoxa	Poaceace	Grass	Annual	3	0.36	1.78
setaria	Asteraceae	Broad leaf	Annual	3	0.14	0.69
Tagetes minatu L.	Asteraceae	Broad leaf	Annual	17	1.81	9.11
Sorghum Halipense	Leguminosae	Broad leaf	Annual	1	0.14	0.69
Xanthium strumarium L.	Asteraceae	Broad leaf	Annual	2.04	10.23	22
Digitaria ischaemum (Schreb.)	Poaceaceae	Grass	Annual	18	2.3	10.23
Solonium Nigrum	Solonacea	Herb	Biennial	4	0.46	2.33

climatic condition of Bule Hora, dissimilar with any of other districts, their similarity index raged from 46.66%-57.89 and below 60%. Weed growth, population density and distribution vary from place to place depending upon altitude, soil and climatic factors that affect the weed flora, and farmers' management practices [11] (Table 6).

Major Weed flora recorded from Teff fields

In Teff fields about 21 floras of weed species which grouped under 7 families of the weeds were identified from four districts, where the survey was conducted (Table 7). The result from this assessment showed that, broad leaf weeds were the dominant the other weed species. Among a total of 21 weed species of farm fields' 54.55% broad leaf, 27.27% grass types and 18.18% sedge types (Table7-8).

Table 6: Similarity index showed that weed species composition in maize was varied between districts.

Dis	Abaya	Bule Hora	Teltalle	Yaballo
Abaya	100	46.66	57.89	72.22
Bule Hora		100	47.36	47.61
Teltalle			100	80
Yaballo				100

Table 7: Number of weed families identified and number of species they comprise in Teff.

S/N	Weed flora Family	No. of Species
1	Compossiteae	2
2	Papaveraceae	1
3	Asteraceae	7
4	Poaceace	7
5	Cyperaceae	1
6	Solanaceae	2
7	Leguminosae	1
	Total	21

The similarity Index of weed recorded from Teff fields over the districts

Similarity index of weed species grown in Teff fields across the districts showed that weed species composition were varied in some districts. But, weed communities of crops grown in Yabello district with Teltelle were similar. Their similarity index also ranges from 66.67% and its result shows above the standard percentage of similarity index (60%). Therefore, for these districts in area where Teff is cultivated similar management methods can be designed to overcome the effect of weed on Teff production. While at Bule Hora & Abaya dissimilar with any of other districts; their similarity index raged from 27.27%-50 % and below 60%. As described by Kefale et al., (2021), weed flora differ depending upon environmental conditions and weed control practices. The same weed management practices would be advised for districts that shown the similarity index greater than 60% (Table 9).

Major Weed flora recorded from Wheat fields

Totally 12 weed flora species with 5 families were identified from wheat field at Bule Hora district. The identified weed species abundance was ordered as follows, grass weeds dominate over Broad leaf and sedge weed species. Among a total of 12 weed species of farm fields' 36.36% broad leaf, 54.55% grass types and 9.09 % sedge types (Table 10-11).

Conclusions and Recommendations

Weeds are a major challenging factor for crop productions. In addition, the cultivation practices also may have its own impact on presence and density of the weed raised in crops. When comparing the identified weed species from all the surveyed fields the Poaceacae and Asteraceae families are the most dominant weed families across the districts. But their abundance percentage is varying across the districts based on the crop cultivated. This may due to environmental

Table 5: Major weed species identified in maize fields.

Botanical Name	Family	Category	Life Cycle	Frequency	Abundance (%)	Dominance (%)
Amaranths hybrids	Compositeae	Broad leaf	Annual	11	0.82	4.89
Ageratum conyzoides	Asteraceae	Broad leaf	Annual	3	0.60	3.56
Argemon Mexicana	Papaveraceae	Grass	Annual	9	0.34	2.00
Avena fatua	Poaceaceae	Grass	Annual	8	1.84	10.98
Biden's pilosa L.	Asteraceae	Broad leaf	Annual	6	0.81	4.80
Cynodon dactylon (L.) Pers.	Poaceace	Grass	Perennial	16	1.12	6.67
Cyprus esculenta L.	Cyperaceae	Sedge	Perennial	5	1.04	6.22
Datura stramonium L.	Solanaceae	Broad leaf	Annual	6	0.41	2.44
Galinsoga parviflora (Cav.)	Asteraceae	Broad leaf	Annual	9	1.83	10.89
Guizotia scabra	Composite	Broad leaf	Annual	6	0.97	5.78
Nicandra physalodes (L.) Gaertn.	Solanaceae	Broad leaf	Annual	2	0.11	0.67
Parthnium hysterophus	Asteraceae	Broad leaf	Annual	26	1.09	6.49
Phalaris paradoxa	Poaceace	Grass	Annual	10	0.34	2.00
Poeannual	Poaceace	Grass	Annual	2	0.09	0.53
Setaria	Poaceaceae	Grass	Annual	9	0.34	2.00
Sonchus asper (L.) Hill.	Asteraceae	Broad leaf	Annual	8	0.30	1.78
sorghumhalipense	Poaceaceae	Grass	Perennial	6	0.34	2.00
Tagetes minatu L.	Asteraceae	Broad leaf	Perennial	16	1.23	7.33
Trifolium rueppellianum	Leguminosae	Broad leaf	Annual	2	0.11	0.67
Xanthium strumarium L.	Asteraceae	Broad leaf	Annual	30	1.92	11.42
Solonium Nigrum	Solonacea	Herb	Biennial	4	0.46	2.33

Table 9: Similarity index of weed species composition in Teff.

Dis Abaya	Bule Hora	Teltalle	Yaballo	Yaballo
Abaya	27.27	41.17	50	72.22
Bule Hora	100	38.46	29.16	47.61
Telltale		100	66.67	80

Table 10: Number of weed families identified and number of species they comprise in wheat fields.

S/N	Weed flora Family	No. of Species
1	Papaveraceae	1
2	Asteraceae	3
3	Poaceace	5
4	polygonacea	1
5	Commelinaceae	1
	Total	12

Table 11: Major weed species Identified from Wheat fields in Bule Hora

Botanical Name	Family	Category	Life Cycle	Frequency	Abundance (%)	Dominance (%)
Argemon Mexicana	Papaveraceae	Grass	Annual	1	0.73	5.11
Avena fatua	Poaceace	Grass	Annual	2	0.63	4.11
Bidens pilosa L.	Asteraceae	Broad leaf	Annual	9	1.56	10.29
Rumex absinicus	polygonacea	Narrow leaf	Perennial	2	0.94	6.17
Cynodon dactylon (L.) Pers.	Poaceacae	Grass	Perennial	1	0.63	4.11
Commelina benghalensis L.	Commelinaceae	Broad leaf	Annual	4	1.13	7.46
Digitaria ischaemum (Schreb.)	Poaceacae	Grass	Annual	2	0.94	6.17
Galinsoga parviflora (Cav.)	Asteraceae	Broad leaf	Annual	1	0.78	5.14
Lolium temulantum L	Poaceacae	Grass	Annual	1	0.94	6.17
Other grass species	Poaceacae	Grass	Annual	8	0.45	2.67
Parthnium hysterophus	Asteraceae	Broad leaf	Annual	26	2.50	16.46

factors such as rainfall longevity, temperature, humidity, soli type, and other synthetic and natural factors. Weed species composition varied between four selective districts at both Zones. Therefore, when developing a weed control strategy in the future, different weed management options would be required for the districts differing in weed flora composition. In contrast to those which have the same similarity index, for management of these districts weed species composition similar management method should be used. Most of the major weed species were broadleaf and grass species. Any weed control strategy should focus on these major weeds. Awareness creation among farmers and experts should start from site selection till post-harvest handling. This may achieve through organizing different trainings for Agro pastoralists (producers) how to protect crop from weed and other agents. Organ like, agricultural offices, research centers and NGO's must cooperate and delivers information's about the risk coming with weed infestation.

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