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Wheat Weed Identification And Management Under Cereal Production System Nepal

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A survey and weed sampling was carryout in wheat and boro rice[1] field to know local knowledge on weed management practices and weed intensity, diversity under rice-maize-wheat cropping system of 25 household (HHs) at Chitwan (Seven VDCs). The survey and field works are carried out more specially at spikelet initiation stage of wheat during February to April, 2011. Both qualitative and quantitative data were collected. Wide range of weeds species were recorded from system. We record more than 38 different weeds species in upland[2] (24), lowland[3] (38), herbicides applied field (23) and Zero Tillage wheat (28). *Chenopodium album, Vicia sativa, Vicia hirsutum, Anagalis arvensis, Oxalis corniculata* were major weed on the basis of density and frequency where as *Polypogon fudax, Polygonum plebijum, Chenopodium album, Solanum nigrum,* Gnaphalium affine *Anagalis arvensis,* are major weed in wheat field on the basis of frequency of weed population and density. Higher numbers of wheat tiller and total weed species were counted under lowland conditions. Total weed population was 332.4%, 350%, 165.3% higher in lowland, upland and zero tillage than herbicides applied field respectively. Around 44% farmer used their own seed for wheat sowing by two-three time harrowing and *culti*[4] by using 72%. Broadcasting methods was popular methods of wheat sowing without maintaining row spacing and farmer doesn't know role of different cultural practices on weed controlling effect on wheat. Only 72% farmers are awarded about yield loss due to weed and degrees of yield lose was 0-25%. Thirty six percent farmers used herbicides on rice and wheat production only even had not quantified rate and herbicides name. Butacllor (In rice) and 2 4 D (In wheat) were popular herbicides. Farmer suggested that *Cyperu , Echinochloa, Cynodon dactylon, Cammelina, portulaca, Ludwigia* were common weeds of rice and *Ageratum, Cynodon dactylon, Digitaria, Brachiaria ramossa and Echinochloa* were common for maize crop.

Keywords: Nepal, cereal production system, wheat, weed management

Introduction

Wheat, maize and rice contribute about 80% of the global cereal production. Weeds are undesirable plants, which infest different crops and inflict negative effect on crop yield either competition for water or nutrients or space or light (Reddy and Reddi, 2011). There are innumerable reports on the inhibitory effects of weeds on crop plants (Javaid *et al.*, 2007). Weeds are notorious yield reducers that are, in many situations, economically more important than insects, fungi or other pest organisms. Poor weed control is one of the major factors for yield reduction of rice depending on the type of weed flora and their intensity (Amarjit *et al.*, 1994). Weed growth reduced the grain yield by 68-100% for direct seeded aus rice, 16-48% for transplant aman rice and 22.36% for modern boro rice (Mamun, 1990). *Echinochloa colona, E. crus-galli, Cyperus iria* and *Ageratum conyzoides.* Crop weed competition reduced straw yield by 13% to 38% and grain yield by 25% to 47% (Manandha *et al*., 2007). *Phalaris minor* Retz., *Rumex dentatus* L., *Coronopus didymus* (L.) Sm., *Medicago denticulata* Willd., *Chenopodium album* L., and *Poa annua* L. are the major weeds of wheat crops in Panjab, Pakistan (Siddiqui *et al*., 2010). It has been estimated that globally yield reduction in wheat due to weeds is 13.1% (Oerke *et al*., 1994). Rice, Maize and Wheat dominate cropping sequence in Nepal in term of acreage and production. In terai region mainly wheat is sown as winter (spring) season than maize and rice. However, at low land condition spring season remain fallow sometime due to over moisture or Boro rice is practiced.

Rice yield loss under weedy area in Asia varies from 45-75% in direct seeded lowland and 50% in transplanted lowland (Johnson 1996). At low density, weeds do not affect yield and certain weeds can even

stimulate the crop growth (Thijssen 1991). Generally, weed-crop competition is complicated as weeds are competitor of crop plants by occupying a space, light, moisture and nutrient which would otherwise be available to the crop plant. Anything that reduces the space which reduces the plant growth (Wright *et al.*, 2001), water requirement for wild mustards is four time more than crop plant, (Thakur, 1984), weed and canopy architecture especially plant height, location of branches and height of maximum leaf area determine the impact of competition for light (Cudeny *et al.*, 1991). 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.

Methodology

Survey

This study was carried out in two parts. First parts were information collection by semi-open types of questionnaires in selected 25 farmers in different parts of Chitwan (Bharatpur Municipality; Gunjanagar, Mangalpur, Kathar, Pithiwa, Shivanagar and Patihani VDCs of Chitwan district). The field survey and weed collection was carries out between wheat growing period 2011.

Weed Characterization

Seconds parts of studies were characterizing the different weeds species at farmer fields' condition. Weeds were collected from 25 farmer's fields when weed growth stage was coincided with milking stage of wheat so that must of weeds were in flowering stage. We used 0.25 m^2 quadrate to collect the weed and wheat tillers sample. Weeds within quadrate were uprooted than grouped them based different character as listed below and count the tillers of wheat. Nepal Agriculture Research Council (Ranjit, 2008), CIMMYT (Gopal *et al*., 2010) publication were used to identify the weeds at field and unidentified weeds were taken to NARC head office as well as Botanical garden at Godawari, Kathmandu by making herbarium.

Most problematic weeds species and their management practices in rice and maize were asked to farmers. Wheat land holders farmer ($\geq$ 0.33 ha.) were selected. This farmer had following types of land and tillage use practices upland and lowland holder, Zero-Tillage and Conventional tillage user. We had collected name list of the 70 farmers and only 25 farmers were selected for study based on 95% confidence level maintain.

Data analysis

After the quantitative weed measurements eg density, relative density, frequency, and relative frequency, summed dominant ratio (SDR) were calculated (Rao 1985 and Sen 1981). Initially MS Exal were used to compile the data.

- Density (D) = Total number of individuals of a species in all quadrates / Total number of quadrates used
- Frequency (F)= (Number of quadrates in which a given species occurs/Total number of quadrates used)
- Relative density (RD) = (Density of a given species / Total density for all species) × 100
- Relative frequency (RF) = (Frequency of a given species / Total frequency for all species) × 100
- Summed Dominant Ratio (SDR) = (Relative density/Relative frequency) × 100

Visit to boro rice field

Boro rice and weed infestation was observed in Bhuvanbasti VDC at Chitwan district. The field was initially treated with glyphosate (pre-plant herbicides) followed by bispirybac.

Result and Discussion

Survey

Around 44% of surveyed area used their own seed which was followed by agro-vet (28%) and only 12% farmers used neighbor seed. Farmyard manure (FYM) was popular among the farmers but some farmers used chemical fertilizer along with FYM/ poultry manure but irrigation facilities were not available at this studies area. They depends on natural rainfall.

Under the Rice-Maize-Wheat cropping pattern tractor drawn *harrow* and *culti* were major source of tillage equipment. Smaller holder farmer used local plough but it was very rarely. Except Zero tillage, the 72% farmers followed two to three time ploughing were comment practices. Thus broadcasting methods of sowing was common (80%), thus spacing of wheat cultivation had no idea among the farmers. Seed rate was also varied from 90-150kg/ha.

It was analysis that farmer had not idea on different cultural practices (Crop rotation, Green maturing, Plant density, Intercropping, Crop residue management, Sowing time, Sowing method and Irrigation) on weed cultivation. This table showed rating of different cultural methods on weeds control.

Table 1 Farmer perception (rating) on different cultural practices and their usefulness for weed management on wheat field (25 HHs)

Cultural practices	Useful %	Satisfactory %	Useless %
Crop rotation	16	56	28
Green maturing	40	36	24
Plant density	44	48	8
Intercropping	24	36	40
Crop residue management	36	44	20
Sowing time	40	48	12
Sowing method	20	48	32
Irrigation	52	32	16
Summer fallow	20	28	52

Majority of perceived that different cultural practices had more or less similar effect on weed control because that gave satisfactory result on different cultural parameter. Irrigation practices had significant effect on weeds control followed by planting density but way to maintaining planting density was not clear until. Farmer estimated that yield losses due to weed in field condition also varies from 0 to 25%. Out of 25 HHs, only 28% farmer had no idea on weeds and grain yield loss relationship.

Under the cereal production system; herbicides was used in rice and wheat production but number of herbicides applicant were very few (36%). But they can't quantify rate and named of herbicides. They taken from agrovet with suggestion by neighbour based on color of bottle and types of herbicides (Granular, liquids and dust). Butachlor was recorded as popular pre-emergence herbicides in rice; 2-4 D Sodium salt was popular in wheat field as post emergence (25-30 DAS); same had been reported by Ranjit 1997. Other herbicides also existed but difficult to identify with farmer information.

Under the wheat field; no weeding was practices but somewhere manually weeding was done to feed the domestic livestock. But in case of rice two manual weeding were done at 25-30 DAS (1st weeding) and 45-55 DAS (2nd weeding). At least one hand weeding was done alone with herbicides applied rice fields. Maize crops were plough by ox drawn at knee height stage then slightly manipulate the soil and plants manually in some part but completely manually weeding at least one time at 30 DAS than knee height stage.

Farmer perception for rejecting or reluctant to use herbicides in crop production was due to following reason.

- Lack of knowledge on herbicides
- Just follow the traditional system
- Negative effects on the environment
- Not available in the market
- Expensive market price

Out of 64% farmer; majority were reluctant/rejecting to use the herbicides due to lack of knowledge on herbicides which is followed by just following the traditional system of cultivation then other group of farmer told negative effect on environment and soon. Farmer had some most problematic weeds in their field which were same as earlier study by different researcher the weeds of Weed flora found in maize field at Chitwan condition was similar with finding of Gupta et al, 1977; Dongal et al, 1988. Dominate weeds in rice were different in different farmer but according to them this were commonly weeds in field. This finding were more or less similar with NARC, 2001, 2000

Table 2. Problematic weed in rice and maize were suggested by farmers were

A. upland rice			
Sn	Botanical Name	Local Name	Family
1	*Cyperus*	Mothe	Cyperaceae
2	*Echinochloa*	Sama	Poaceae
3	*Ageratum*	Gandha	Asteraceae
4	*Cynodon dactylon*	Dubo	Poaceae
5	*Paspalum*	Ghod dubo	Poaceae
6	*Ludwigia*		Onagraceae
B. Low land rice			
1	*Cyperus*	Mothe	Cyperaceae
2	*Echinochloa*	Sama	Poaceae
3	*Eclipta prostrate*	Bhrinjigraj	Asteraceae
4	*Cammelina*	Kana	Cammelinaceae

Table 2. Continued

5	*Galinsoga ciliate*	Marati	Asteraceae
6	*Monochoria*	karkalla	Pontederiaceae
7	*portulaca*		

C. Under maize

1	*Ageratum*	Gandha	Asteraceae
2	*Cynodon dactylon*	Dubo	Poaceae
3	*Digitaria*		
4	*Brachiaria ramossa*		
5	*Cammelina*	Kana	Commelinaceae
6	*Echinochloa*	Sama	Poaceae

Weed Characterization

We collected and characterized the weed species. The upland, following weeds species was observed and found that *Chenopodium album* (342 SDR) was must problematic weeds among 22 identified weeds species which was followed by *Drymaria cordata, Anagalis arvensis, Rumex crispus*, . This finding is similar with NARC, 2000, 2001, 2004; Ranjit et al, 2010; Siddiqui et al 2010.

Table 3. List of wheat field weeds at upland of Chitwan, 2011

Name of weeds	Upland				
	D	F	RD	RF	SDR
Avena fatua	0.71	0.43	0.44	3.8	11.6
Phalaris minor	2.86	0.29	1.76	2.53	69.6
Chenopodium album	49.1	1	30.3	8.86	342.1
Vicia hirsutum	8.71	0.86	5.37	7.59	70.76
Vicia sativa	10.4	1	6.43	8.86	72.59
Anagalis arvensis	15.1	1	9.34	8.86	105.4
Solanum nigrum	2.86	0.57	1.76	5.06	34.8
Oxalis corniculata	8.14	0.86	5.02	7.59	66.12
Medicago denticulate	0.71	0.43	0.44	3.8	11.6
Fumaria parviflora	5.57	0.71	3.44	6.33	54.29
Cynadon dactylon	1.71	0.43	1.06	3.8	27.84
Gnaphalium affine	0.57	0.29	0.35	2.53	13.92
Polypogon fudax	2.43	0.43	1.5	3.8	39.44
Polygonum plebijum	15.1	0.86	9.34	7.59	123
Drymaria cordata	26.1	0.57	16.1	5.06	318.4
Euphorbia spp	0.14	0.29	0.09	2.53	3.48
Rumex crispus	7	0.57	4.32	5.06	85.26
Spergula arvensis	2.29	0.14	1.41	1.27	111.4
Melilotus indica	0.43	0.14	0.26	1.27	20.88
Ammania baccifera	0.71	0.14	0.44	1.27	34.8
Other number	0.71	0.14	0.44	1.27	34.8
B Galinsoga spp	0.57	0.14	0.35	1.27	27.84

*D-Density, F-Frequency, RD-Relative Density, RF-Relative Frequency, SDR-Summed Dominant Ratio

Above table clearly show that total 10 weeds have higher frequency. In upland there are some unidentified species but more than 22 species were recorded in wheat field at upland condition. *Drymaria cordata* have higher SDR but less frequency.

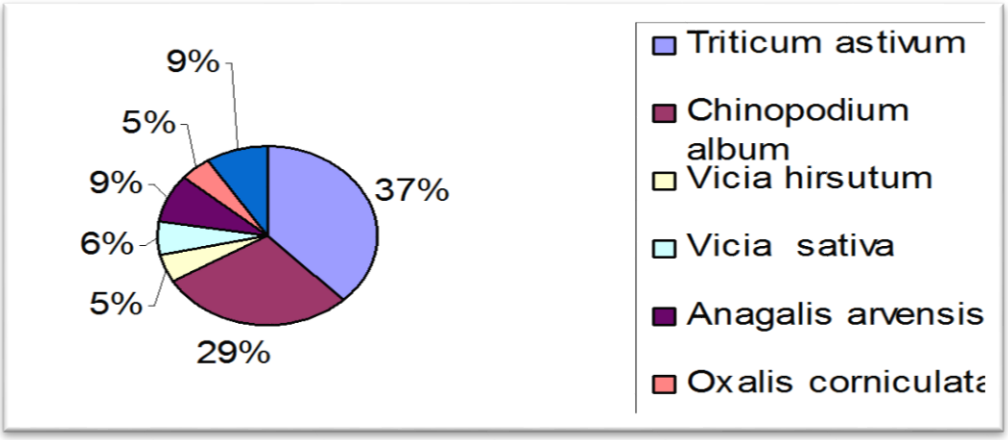

Figure 1: - Must dominant weed at upland on the basis of frequency and density

The figure showed that comparative population of five important weeds with wheat tiller number. This figure does not include remaining species for comparison.

Figure 2: - *Vicia sps* in wheat field in upland

Figure 3: - weeds species in upland wheat fields

Figure 4: - Using quadrate for weed sampling (Author at Center)

Figure 5: - Weeds in upland wheat field

Under low land, weeds diversity was higher but density was low. There were 37 weeds species were recorded. *Fumaria parviflora*, *Spergula arvensis* and *Melilotus indica* are not recorded in low land but found in upland. Following species were recorded in low land only against upland.

- *Stelaria media*
- *Cyprus sps*
- *Galinsoga ciliata*
- *Eclipta prostrata*
- *Echinochloa colona*
- *Caesulia axillaris*
- *Lathyrus aphaca*
- *Amaranthus viridis*
- *Ageratum Spp*
- *Malva parviflora*
- *Ludwigia hissopifolia*
- *Polygonum hydropiper*
- *Dopatrium junceum*
- *Coronopus didymus*
- *Stellaria aquatiica*

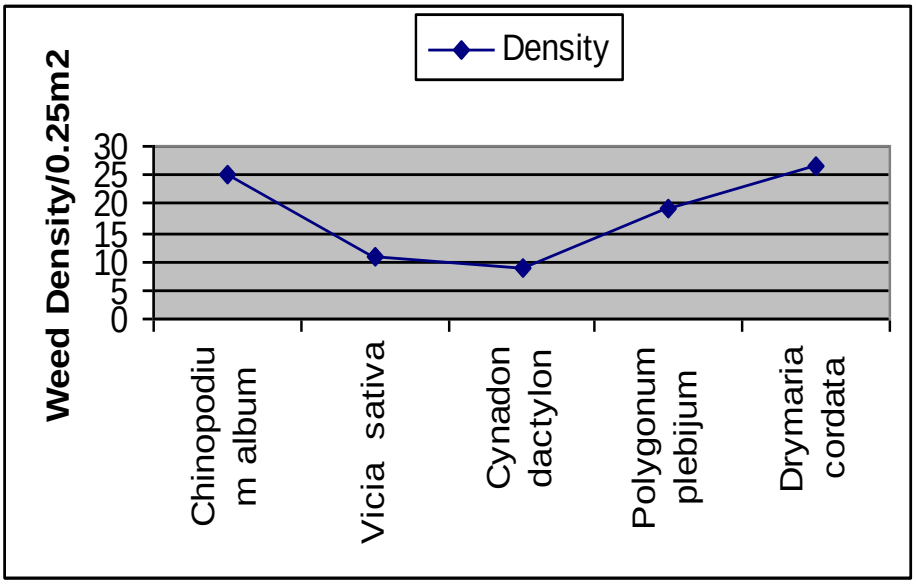

Figure 6: - Important weeds of lowland on basis of density.

Weed density were low in lowland compared to upland but diversity increased. Among problematic weeds in lowland *Chinopodiun album* was never second because its frequency also higher than *Drymaria cordata*

Figure 7: - Characterization weed of lowland wheat (Author at Center)

Figure 8:-weeds species in lowland wheat field

Figure 9: - Placing of quadrate ($0.25m^2$) for counting weeds and wheat tiller

Table 4 List of wheat field weeds at low land of Chitwan, 2011

Name of weeds	Low lands				
	D	F	RD	RF	SDR
Phalaris minor	0.63	0.13	0.35	0.88	39.34
Chenopodium album	24.9	1	13.7	7.02	195.7
Vicia hirsutum	3.88	0.75	2.14	5.26	40.65
Vicia sativa	10.8	1	5.94	7.02	84.58
Anagalis arvensis	8.38	0.63	4.62	4.39	105.4
Solanum nigrum	15.1	0.38	8.35	2.63	317.3
Oxalis corniculata	3.38	0.63	1.86	4.39	42.48
Medicago denticulate	1	0.75	0.55	5.26	10.49
Cynadon dactylon	8.63	0.88	4.76	6.14	77.55
Gnaphalium affine	6	0.63	3.31	4.39	75.53
Polypogon fudax	8.13	0.63	4.49	4.39	102.3
Polygonum plebijum	19.1	0.63	10.6	4.39	240.7
Galinsoga ciliate	2.38	0.38	1.31	2.63	49.83
Drymaria cordata	26.5	0.63	14.6	4.39	333.6
Stelaria media	5.88	0.5	3.24	3.51	92.44
Euphorbia spp	0.63	0.25	0.35	1.75	19.67
Cyprus sps	2	0.38	1.1	2.63	41.96
Rumex crispus	3.75	0.38	2.07	2.63	78.67
Eclipta prostrate	0.63	0.13	0.35	0.88	39.34
Echinochloa colona	0.5	0.13	0.28	0.88	31.47
Caesulia axillaris	0.13	0.13	0.07	0.88	7.867
Lathyrus aphaca	0.25	0.25	0.14	1.75	7.867
Amaranthus viridis	0.63	0.25	0.35	1.75	19.67
Ageratum Spp	0.5	0.13	0.28	0.88	31.47
Malva parviflora	1.25	0.13	0.69	0.88	78.67
Ludwigia hissopifolia	1.38	0.38	0.76	2.63	28.85
Spergula arvensis	5.75	0.5	3.17	3.51	90.48
Ammania baccifera	0.5	0.13	0.28	0.88	31.47
Polygonum hydropiper	1.38	0.13	0.76	0.88	86.54
Dopatrium junceum	1.88	0.13	1.04	0.88	118
Coronopus didymus	0.25	0.13	0.14	0.88	15.73
Other number	9.88	0.63	5.45	4.39	124.3
Stellaria aquatiica	0.5	0.13	0.28	0.88	31.47
Galinsoga spp	4.38	0.38	2.42	2.63	91.79
Dactyloctenium aegypticum	0.38	0.13	0.21	0.88	23.6

Polypogon fudax, Polygonum plebijum, Chenopodium album, Solanum nigrum, Gnaphalium affine *Anagalis arvensis,* are major weed in wheat field on the basis of frequency of weed population and density.

Under herbicides application field weed population were low compared to upland as well as lowland. Farmer was unable to told name of herbicides and dose to be applied. It generally found that 2-4 D, isoproturone, glyphosate were used in field Condition.

Figure 10: - Weeds under herbicides application fields at Chitwan

Few farmers used herbicides as pre-plant application but majority of them used herbicides as post emergence. Lack of knowledge on herbicide application methods, negative impact of herbicides on wheat tiller so low tiller number of wheat at herbicides application field was found. Wheat tiller were also low in herbicides applied fields.

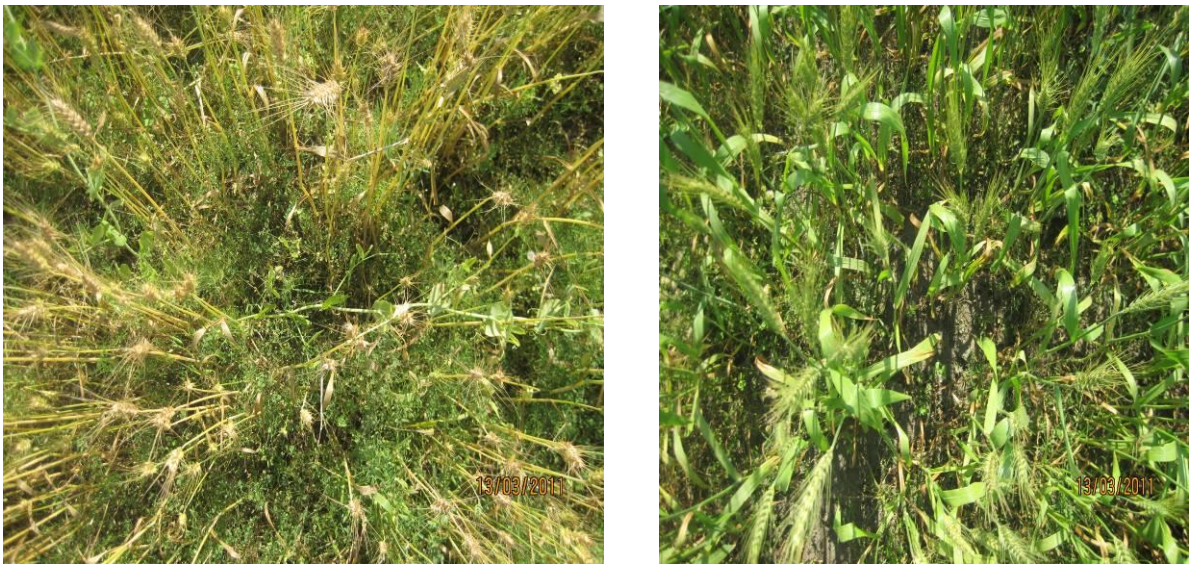

Figure 11: - Weed population in herbicides not applied field (Right) and applied field (Left)

Table 5. List of wheat field weeds at Herbicides applied field of Chitwan, 2011

Name of herbicides	Herbicides applied field				
	D	F	RD	RF	SDR
Phalaris minor	0.25	0.25	0.7	1.92	36.62
Chenopodium album	2	0.75	5.63	5.77	97.65
Vicia sativa	1.25	0.25	3.52	1.92	183.1
Anagalis arvensis	0.25	0.25	0.7	1.92	36.62
Solanum nigrum	0.75	5	2.11	38.5	5.493
Oxalis corniculata	0.75	0.25	2.11	1.92	109.9
Medicago denticulate	2	0.75	5.63	5.77	97.65
Cynadon dactylon	4.5	0.75	12.7	5.77	219.7
Gnaphalium affine	1	0.5	2.82	3.85	73.24
Polypogon fudax	2.25	0.5	6.34	3.85	164.8
Polygonum plebijum	2.5	0.5	7.04	3.85	183.1
Galinsoga ciliate	1.5	0.25	4.23	1.92	219.7
Stelaria media	3.5	0.25	9.86	1.92	512.7
Cyprus sps	1.25	0.25	3.52	1.92	183.1
Ageratum Spp	1.25	0.75	3.52	5.77	61.03
Ludwigia hissopifolia	1.5	0.25	4.23	1.92	219.7
Ammania baccifera	1	0.25	2.82	1.92	146.5
Dopatrium junceum	3.75	0.25	10.6	1.92	549.3
Other number	2	0.25	5.63	1.92	293
Stellaria aquatiica	1	0.25	2.82	1.92	146.5
Dactyloctenium aegypticum	0.75	0.25	2.11	1.92	109.9
Galinsoga spp	0.5	0.25	1.41	1.92	73.24

Ageratum Spp, Cynadon dactylon, Cyprus sps, Medicago denticulate, Chenopodium album were dominated weeds in this area. Farmer told that *Cynadon* was not killed by any herbicides used but *Cyprus* was appeared after 15-20 day after herbicides spray.

It is also found that higher numbers of wheat tiller and total weeds species count were found under lowland condition which was nearly 39.6% and 60.7 % higher than herbicides applied field. It was shown in figure that tiller and total weeds count (40%) were higher in lowland compared to upland. Under the Zero tillage (ZT) higher tiller and total weeds count were more than herbicides applied field. ZT wheat were done under the lowland with the help of herbicides (pre-plant as well as post emergence)

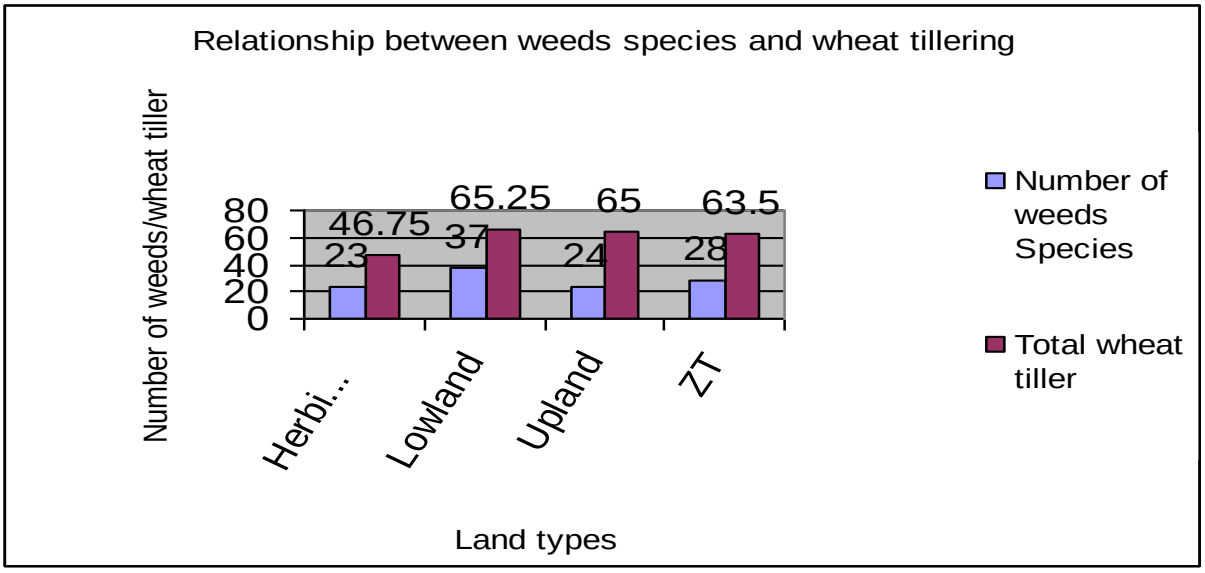

Figure 12: - Relationship with wheat tiller and total weed count under different land ecology (0.25 M^2)

It was interesting that total weed population was 332.4%, 350%, 165.3% higher in lowland, upland and zero tillage than herbicides applied field respectively. As compared to zero tillage, lowland and upland had 62.9% and 69.5% higher in total weeds population.

C. boro rice

It was observed that low land condition at Bhuvanbasti VDC initially this field was treated with pre-plant herbicides but *Cyprus iria, C. compressus, C. difformis, C. rotundus* as well as *fimbristylis, Echinochloa, Eclipta prostrate,Portulaca oleracea, monochoria viginalis and Cynodan* were observed. At 35 DAS they are going to spray bispyribac as post-emergence herbicides.

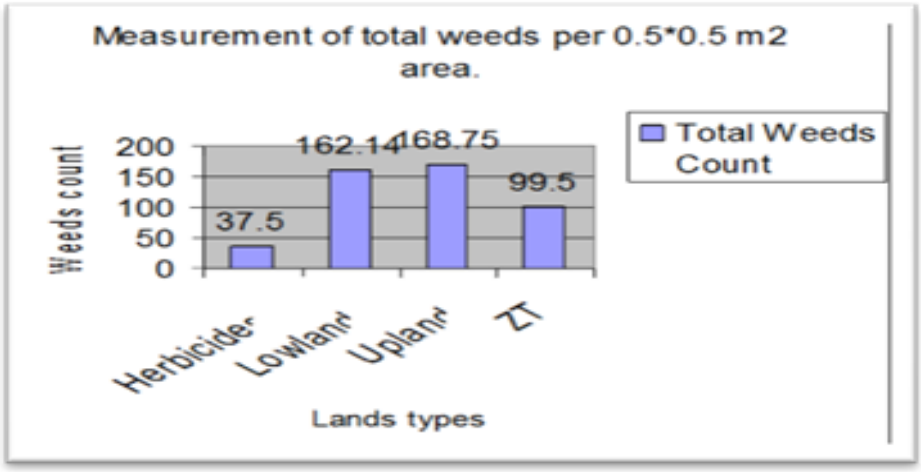

Figure 13. Measurement of total weeds per o0.0*5 m2 area.

Conclusion

Weed was major production constraint in wheat at Chitwan. Farmer was unknown about weed and their negative effect in grain yield of wheat. Majority of farmers used their own seed under limited supply of water. Two to three times were common tillage practices by harrow and culti. Broadcasting was method of sowing, so maintenances of spacing and their role on weed control was also unknown among farmers. Few farmers used herbicides to control the weed on rice but even less used herbicide on wheat but maize was completely weeded physically.

Cyperus, Echinochloa, Cammelina, Monochoria, Ludwigia were major weeds in rice crop as recorded by farmers. *Ageratum, Cynodon dactylon, Digitaria, Brachiaria ramossa, Echinochloa and Cammelina* was weeds of maize crop.

Weeds species diversity was very high in lowland compared to upland non-irrigated lands. It was found that must problematic weeds species also different according to land ecology. In lowland, *Gnaphalium affine, Anagalis arvensis, Drymaria cordata, Malva parviflora* and *Panicum dichotomiflorum* were dominated weeds, but *Chenopodiun album (*143/ squired*), Rumex crispus.*

It was found that altogether more than 38 weeds species were recorded in wheat field at different ecology of Chitwan. Under the upland condition, only 24 species was found, similarly 23, 28, 38 species were recorded in Herbicides applied field, ZT and lowland respectively. It was interesting that total weed population was 332.4%, 350%, 165.3% higher in lowland, upland and zero tillage than herbicides applied field respectively. As compared to zero tillage, lowland and upland had 62.9% and 69.5% higher in total weeds population.

Cynodon dactylon, Ageratum species, Oxalis corniculata and *Vicia* species (Small pods and large pods) was common weeds in both low and upland. It also found that under Zero tillage wheat, rice weeds were more dominate ex. *Cyperus* species.

Farmer at BhubhanBasti say, *Galinsoga ciliata* was new weeds in this community and it is appeared sine last 2-3 years. Some farmer use herbicides but *Cynodon dactylon* was not controlled. Farmer perception on yield loss due to weeds infestation in wheat was very low. They assume only 0-33% loss so weed control practices is not common on wheat fields.

Only few farmers used herbicides in rice only but majorities of farmers were unknown about chemical weed control, some farmer reluctant to use herbicides due to environmental concern and other farmer

following just traditional system of cultivation so they didn't know about herbicides.

Under boro rice, *Cyperus* spp was major problem. It was observed that low land condition at Bhuvanbasti VDC initially this field was treated with pre-plant herbicides but *Cyprus iria, C. compressus, C. difformis, C. rotundus* as well as *fimbristylis, Echinochloa, Eclipta prostrate,Portulaca oleracea, monochoria viginalis and Cynodan* were observed. At 35 DAS they are going to spray bispyribac as post-emergence herbicides.

Notes

1. Submerge rice
2. Rainfed area
3. Irrigated area
4. A types secondary tillage equipment

Reference

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