Asian Journal of
Crop Science

Research Article
Weed Survey in Sweet Corn (*Zea mays saccharata* Sturt.) in Regency of Sumedang and Bandung Indonesia

Denny Kurniadie, Uum Umiyati and Dedi Widayat

Faculty of Agriculture, Padjadjaran University, Jalan Raya Bandung, Sumedang Km. 21 Jatinangor, Indonesia

Abstract

Objective: The objective of this study was to investigate the dominant weed species on sweet corn in two sweet corn production centers in West Java (Sumedang and Bandung Regency). **Methodology:** The materials used in this experiment was weed that grows in sweet corn, basic map and quesioner. The instruments used in this experiment were the square meters (0.5×0.5 m), hoe, scale, plastic rope, plastic bags, a spade, electric scale, dryer oven and altimeter. The study was carried out in Sumedang Regency (District Pamulihan and Sukasari) and Bandung Regency (District Cileunyi and Arjasari), each Regency consisted of 12 sweet corn farms. The study was carried out from March, 2014 until July, 2014. The experimental design used was descriptive with survey method. Each district consisted of 6 sweet corn farms. There were 12 observations on each Regency, so the total observations were 24 observations. **Results:** The results of this study showed that based on Sum Dominance Ratio (SDR) analysis, the dominant weeds found in Sumedang Regency were *Ageratum conyzoides* and *Eupatorium odoratum* L. (broad leaves) and *Cyperus rotundus* (sedge), whereas the dominant weed species found in Bandung Regency only *Ageratum conyzoides* (broad leave). The comparison of coefficient communities value (C) between Regency of Sumedang and Bandung was of 69.75% which means that, the weed population in Bandung and Sumedang was different. The total value of species diversidty index (H') in districts Pamulihan, Sukasari, Arjasari and Cileunyi were 1.18, 1.12, 1.39 and 1.35 consecutively, which means a relatively low diversity category. **Conclusion:** The dominant weeds and weed population in Bandung Regency and Sumedang Regency were different. All weed population in all study areas have low diversity.

Corresponding Author: Denny Kurniadie, Faculty of Agriculture, Padjadjaran University, Jalan Raya Bandung, Sumedang Km. 21 Jatinangor, Indonesia
Tel/Fax: +62 22 7796316

Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

The presence of weeds in sweet corn crop can reduce both yield and seed quality. Yield loss of crop due to weed depend on type of weed, weed density, length of competition and allelopathy. Generally, yield loss due to weed can exceed yield loss due to pest and diseases. Nevertheless, yield loss due to weed was quite hard to predict, due to the effects were not easy to observed. Some studies show that there was negative correlation between dry weight of weeds and yield of corn, with the decline in yield[1] can be up to 95%. Corn grown in monocultures and with low input do not give high yield due to weed competition[2]. The amount of yield loss in corn due to weed competition was ranged[3] from 16-62%. Therefore, weed control is necessary to reduce weed infestation and crop losses. Yield loss in crop mostly due to competition with light, water, nutrients and space between crop and weed[4]. There were many factors that affect the diversity of weed species such as light, temperature, water and wind[5]. Soil factors (moisture, aeration, pH and nutrients) play an important role in weed diversity. Several weed species can grow better in soil that has certain condition. Soil with has high moisture content will affect the emergence of weed in rice fields. Broad leaves weeds found more dominant in podsolik soil type[6].

Another factor that affects weed diversity was altitude. Weed composition was varied according to different altitude. As an example in North Sumatera and Aceh, rubber plantation with an altitude of 0-30 m a.s.l., the dominant weed species found was sedges, whereas in altitude of 30-100 m, the dominant weed species found was grasses[5]. Cultural method, such as the usage of cover crop, row spacing and cropping system also influence weed diversity[6].

Mapping or survey of weeds in corn in various ecosystems and environmental conditions in two production centers of sweet corn in West Java province (Bandung and Sumedang Regency) is required in order to design the control method of weed in corn effectively. Corn production centers in West Java province in accordance with West Java corn belt program is concentrated in the Regencys of Kuningan, Majalengka, Sumedang, Ciamis, Tasikmalaya, Garut, Bandung and Sukabumi. The objective of this study was to investigate the dominant weed species on sweet corn in two sweet corn production centers in West Java (Sumedang and Bandung Regency).

MATERIALS AND METHODS

The study was carried out in sweet corn farms belongs to farmers in Sumedang Regency (District Pamulihan and Sukasari) and Bandung Regency (District Cileunyi and Arjasari), each district consisted of 6 sweet corn farms. The experiment was carried out from March, 2014 until July, 2014. The materials used in this experiment was weed that grows in sweet corn, basic map and quesioner. The instruments used in this experiment were the square meters (0.5×0.5 m), hoe, scale, plastic rope, plastic bags, a spade, electric scale, dryer oven and altimeter.

The experiment design used was descriptive with survey method. In each Regency will be examined 6 sweet corn farms with has an age between 6 and 8 weeks. Vegetation analysis was determined based on parameters: weed density, weed frequency, weed dominance, Sum Dominance Ratio (SDR), coefficient communities and dry weight of weed. Vegetation analysis was conducted one times in each sweet corn farm. Questionnaire was given to the farmer to find out the history of the studied area of corn, such as crop varieties used, cropping patterns used, kind of fertilizer used, weed control technique, age of corn, row spacing and type of tillage.

A vegetation analysis of weed was calculated based on Tjitrosedirdjo *et al.*[7]: Important value = Relative density +relative frequency+relative dominant and the Summed Dominance Ratio (SDR) is the important value/3, whereas the coefficient communities was calculated based on the following formula:

$$C = \frac{2W}{a+b} \times 100\%$$

Where:
C = Coefficient community
W = The sum of two lowest quantity for each type of community
a = The sum of entire quantity on first community
b = The sum of entire quantity on second community

RESULTS AND DISCUSSION

The study areas profile of Sumedang and Bandung Regency are described in Table 1.

Vegetation analysis of weed: Table 2 showed that there were 30 weed species found in Sumedang Regency that consist of 21 broad leaves weed, 8 grasses weed species and one sedges species. At district Pamulihan there were 2 dominant weed species, namely *Ageratum conyzoides* and *Cyperus rotundus*, while in district Sukasari there were also 2 dominant weed species, namely *Ageratum conyzoides* and

Table 1: Profile of study areas in Sumedang and Bandung Regency

Category	Sumedang Regency	Bandung Regency
Location	Geographically situated between 6°44'-70°83'LS and 107°21'-108°21' BT	Geographically situated between 6°,41'-7°,19' LS and 107°, 22'-108º,5' BT
Total area	152.220 ha	176.238,67 ha
altitude	District Pamulihan: • 750 m a.s.l. District Sukasari: • 700 m a.s.l.	District Arjasari • 600 m a.s.l. District Cileunyi • 800 m a.s.l.
Climate observations (Year 2013)	District Pamulihan: • The amount of rainfall 3065 mm • The number of day rain 165 days District Sukasari: • The amount of rainfall 2157 mm • The number of day rain 166 days	District Arjasari: • The amount of rainfall 2545 mm • The number of day rain 219 days District Cileunyi: • The amount of rainfall 2237 mm • The number of day rain 157 days
Cropping system	District Pamulihan: • Multiple cropping District Sukasari: • Monocultur	District Arjasari: • Monocultur District Cileunyi: • Multiple cropping
Tillage system	Minimum tillage and maximum tillage	Minimum tillage
Variety	Talenta, bonanza, sweet boy	Bonanza, SG 75
Row spacing	50×60 cm and 70×40 cm	70×40 cm
Plant age	5-8 weeks after planting	5-8 weeks after planting
Source of irrigation	Rainfall	Rainfall
Type, dose of fertilizers and application time	District Pamulihan: • Mekarbakti and Ciptasari villages: Urea and NPK 350 kg ha^{-1} District Sukasari: • Sukasari and Sindangsari villages: Urea and phonska 300 kg ha^{-1}	District Arjasari: Urea 100 kg ha^{-1}, TSP 100 kg ha^{-1} and KCL 50 kg ha^{-1} District Cileunyi: • Cinunuk village: Urea 200 kg ha^{-1}, TSP 75 kg ha^{-1} and NPK 50 kg ha^{-1}
Pests, disease and weed control	Chemical and mechanical control method	Chemical and mechanical control method
Average of yield	District Pamulihan: • 15.4 t ha^{-1} District Sukasari: • 22.92 t ha^{-1}	District Arjasari: 23.27 t ha^{-1} District Cileunyi: • 26.37 t ha^{-1}

Table 2: Summed Dominance Ratio (SDR) weed in Sumedang and Bandung Regency

Species	SDR Sumedang Regency (%)		SDR Bandung Regency (%)	
	District Pamulihan	District Sukasari	District Arjasari	District Cileunyi
Broad leaved weed				
Ageratum conyzoides	16.99*	22.45*	14.38*	14,61*
Alternanthera piloxeroides (Mart.) Griseb	-	-	2.89	3.69
Amaranthus spinosus	1.69	2.40	2.23	1.14
Amaranthus viridis	0.40	0.48	1.43	-
Axonophus compressus (Sw.) Beauv.	1.21	-	2.81	2.91
Biden pilosa L.	1.24	-	1.51	1.57
Borreria laepikaulis Schum	2.27	3.08	1.7	2.49
Cleome rutidosperma D.C	6.95	4.42	3.13	1.84
Commelina diffusa	1.13	1.68	2.68	-
Drymaria pilosa Cham and Schlechtend	4.73	4.22	2.70	2.82
Elephantropus L.	-	-	0.95	-
Emilia sanchifolia (L.) DC.	1.05	0.48	1.59	1.73
Ephorbia hirta L.	1.74	1.48	3.34	3.44
Erigeron sumatrensis Retz	1.24	-	0.50	1.29
Eupatorium odoratum L.	7.92	15.03*	2.25	3.98
Galinsoga parpiflora	1.35	1.92	-	-
Mimosa invisa Mar.	-	-	1.85	2.68
Mimosa pudica Duchass. and Walp	2.29	3.43	3.23	4.10
Oxalis barrelieri L.	4.61	6.43	4.89	4.73
Oxalis corniculata	4.34	-	1.30	2.28
Pillanthus debilis Klein ex Willd	1.61	2.36	3.02	3.75
Richardia brasiliensis	-	-	2.04	2.45
Setaria palmifolia (J. Koenig) Stapf	3.21	2.51	2.76	2.61

Table 2: Continue

Species	SDR Sumedang Regency (%)		SDR Bandung Regency (%)	
	District Pamulihan	District Sukasari	District Arjasari	District Cileunyi
Synedrella nodiflora (L.) Gaertn.	1.41	0.48	3.55	6.19
Tridax procumbens L.	2.84	4.73	1.21	-
Grasses weed				
Cynodon dactylon (L.) Pers.	5.43	2.85	6.30	6.44
Digitaria fuscescens (Presl.) Henr.	0.40	0.60	2.79	3.65
Digitaria nuda Schumach	1.55	2.51	-	-
Digitaria setigera (Roem and Schult)	-	-	2.70	-
Eleusine indica (L.) Gaertn	4.98	2.58	6.64	8.98
Eragrostis tenella	-	-	0.95	1.51
Imperata cylindrica (L.) Beauv	2.15	4.13	5.34	5.44
Panicum repens L.	3.50	3.94	1.22	-
Paspalum conjugatum	0.51	0.83	-	-
Portulaca oleracea	0.73	1.08	-	-
Sedges weed				
Cyperus rotundus	10.19*	3.86	5.75	3.71
Total	100.00	100.00	100.00	100.0

*Most dominant of weed

Table 3: Comparison of coefficient community value of weed in Sumedang and Bandung Regency

Comparison regions	C-value (%)
District Pamulihan: Sukasari	49.23
District Arjasari: Cileunyi	66.45
Sumedang: Bandung	69.75

Table 4: Value of species diversity index (H') in Sumedang and Bandung

Observation areas	H'
Sumedang Regency	
District Pamulihan	1.18
District Sukasari	1.12
Bandung Regency	
District Arjasari	1.39
District Cileunyi	1.35

Eupatorium odoratum. The most dominant weed species that found in Sumedang Regency was *Ageratum conyzoides.* This weed species was encountered in all study areas in Sumedang. Weed species of *Ageratum conyzoides* belongs to annual broad leaved weed and has a lot of seeds that easy to be dispersed[8]. *Ageratum conyzoides* species can grow any where because it can adapt to different environmental condition.

In Bandung Regency found that there were 32 weed species found that consist of 24 broad leaves species, 7 grasses weed species and one sedge species (Table 2). The most dominant weed species in district Arjasari and district Cileunyi was *Ageratum conyzoides.* Weed species of *Ageratum conyzoides* was also found in all observation areas in Bandung Regency. This weed can grow to an altitude up to 1200 m a.s.l. Weed of *Ageratum conyzoides* can grow on dry land or moist soil[9]. Weed composition that grows in Sumedang and Bandung Regency was different. This might due to different altitude, climate and cultural method. The different altitude will affect weed diversity. High altitude tend to have more weed as compare with lower altitude[7]. Shifting weed composition occurred as a consequence of farming practices system, such as the tillage system, fertilizer application, weed control methods[10]. The frequency of weeding also causing weed shifting[11].

Coefficient community value of weed: Table 3 showed that the value of coefficient community of weed (C) in all areas of observation in Sumedang and Bandung Regencies were under 75%, which means that the value of C on the district Pamulihan: District Sukasari and so on do not have similarity in population. If the value of coefficient community (C) was more than 75%, the similarity in weed population community between the two regions were large enough, whereas if the value of C was smaller than 75%, there was no similarity in weed population between two population in two regions[7]. Weed diversity in one location was different with other locations. This might due to various factors, such as soil type, altitude and cultural method[12]. The difference in weed species can be caused by change in cultural method and microclimate[13]. If the condition of micro climate was relatively not change, so changing in weed composition will occur very slow or did not changed at all[14].

Species diversity index (H'): The species diversity index (H') of each species in each study area belongs to very low (Table 4). The value of H' usually ranges[15] from 0-7. If H'<1 the diversity index belongs to the category of very low, H'>1-2 belong to low, H'>2-3 belong to moderate , H'>3-4 belong to be higher and H'>4 belong to quite high. District Arjasari

has the highest value of H' (1.39). This probably due to the number of weed species found in this area was very high as compared with the other study areas. The number of weed species found in sweet corn farms in Sumedang and Bandung can be affected by herbicide use, soil tillage system and soil fertility. The value of H' would increase if the number of weed species within the community was increase and weed distribution was more even[15]. Low or high weed diversity in their communities depends on the number of individual weed in the community[16]. Planting system earlier and soil type affect the number and weed diversity[17]. Factors that affect diversity of weed community was altitude[6].

CONCLUSION

- The dominant weeds found in Sumedang Regency were *Ageratum conyzoides* and *Eupatorium odoratum* L. (broad leaves) and *Cyperus rotundus* (sedge), whereas the dominant weed species found in Bandung Regency was only *Ageratum conyzoides* (broad leave)
- The comparison of coefficient communities value (C) between Regency of Sumedang and Bandung was of 69.75% which means that, the weed population in Bandung and Sumedang was different
- The total value of species diversidty index (H') in districts Pamulihan, Sukasari, Arjasari and Cileunyi were 1.18, 1.12, 1.39 and 1.35 consecutively, which means a relatively low diversity category

REFERENCES

1. Violic, A.D., 2000. Integrated Crop Menagement. In: Tropical Maize Improvement and Production, Paliwal, R.L., G. Granados, H.R. Lafitte, A.D. Violic and J.P. Marathee (Eds.). Vol. 28, Food and Agriculture Organization, Rome, pp: 237-282.
2. Clay, S.A. and I. Aguilar, 1998. Weed seedbanks and corn growth following continuous corn or alfalfa. Agron. J., 90: 813-818.
3. Sasmita, E.R., S. Hardiastuti and Dalia, 2003. The use of *Paraquat herbicide* in different system of soil tillage in soybean farm. Proceeding of the 16th National Conference of Weed Science Society of Indonesia (WSSI), July 15-17, 2003, Bogor Indonesia.
4. Nurjanah, U., 2002. Weeds shifting and yield of sweet corn in no tillage system as a result of dosage and time of glyphosat application. Akta Agrosia, 5: 1-7.
5. Utami, S., Asmaliyah and F. Azwar, 2007. Weed inventory under plant of *Alstonia angustiloba* Miq. and its relationship with weed control in Kabupaten Musi Rawas, Sumatera Selatan. Proceeding of Research Results, pp: 135-144.
6. Nasution, U., 1981. Weed inventory in North Sumatra rubber plantation and its relationship with weed management. Proceedings of the 6th Congress of the Weed Science Society of Indonesia.
7. Tjitrosedirdjo, S., I.H. Utomo and J. Wiroatmodjo, 1984. Weed control in plantation. Publication Board Cooperation of Biotrop Bogor and PT Gramedia, Bogor.
8. Solfiyeni, C. and R. Muharrami, 2013. Vegetation analysis of weed in corn (*Zea mays* L.) in upland and lowland rice field in Kabupaten Pasaman. Lampung University, Lampung.
9. Sarwanto, 2013. Ageratum conyzoides. Universitas Musi Rawas, Palembang, Indonesia.
10. Fitriana, M., Y. Parto, Munandar and D. Budianta, 2013. [Shifting of weeds species due to organic matter treatments on upland previously planted with corn]. J. Agron. Indonesia, 41: 118-125.
11. Setyowati, N., U. Nurjanah, Afrizal and L.S. Sipayung, 2007. Weed shifting in pepper as a result of different time of weed control. J. Ilmu-Ilmu Pertanian Indonesia, 1: 21-27.
12. Nasution, U., 1986. Weed control in rubber plantation of North Sumatra and Aceh. Tanjung Morawa Research Center and Development (P4TM). Medan.
13. Mercado, B.L., 1979. Introduction to weed science. Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA), Laguna, Philippines, pp: 292.
14. Sastroutomo and S. Soetikno, 1990. Weed Ecology. PT. Gramedia Pustaka Utama, Jakarta.
15. Barbour, M.G., J.H. Burk and W.D. Pitts, 1987. Terrestrial Plant Ecology. 2nd Edn., Benjamin/Cummings Publishing Co., California, USA., ISBN-13: 978-0805305418, Pages: 600.
16. Odum, E.P. and G.W. Barrett, 2005. Fundamentals of Ecologyi. Cengage Learning India Private Limited, India, ISBN: 8131500209.
17. Knott, C.M., 2002. Weed control in other arable soils. Pedobiologia, 6: 105-128.