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Research Article

THE WEED DIVERSITY ON TOMATO (*Lycopersicum esculentum* Mill) CROP IN MAJALENGKA REGENCY, WEST JAVA PROVINCE, INDONESIA

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Abstract- The Research aims to know the weed diversity on tomato crop in Majalengka Regency, West Java Province. It was conducted in November 2016 as of 2017. It uses the descriptive research method through survey method. After the required sample-plot number is obtained, then carried out vegetation analysis (weed survey). Each of vegetation analysis is determined: weed species, weed density, weed frequency, weed dominance, Summed Dominance Ratio, community coefficient, weed coverage percentage and dry weed weight. The questionnaires are given to farmers to know the history of tomato and carrot, i.e. used plant varieties, used plant pattern, used fertilizer type, weed controlling technique and plant spacing.
The result indicates that weed species contained in tomato crop in Majalengka Regency were 21 species. There are 14 broad-leaved weed species, 6 grass species and 1 nut grass, dominant weed species found in the tomato crop in Majalengka Regency are 8 species. 5 broad-leaved weed species are recorded, *i.e., G. parviflora, D. villosa, O. trifolia, A. conyzoides and A. vulgaris*, 2 grass species *i.e., E. indica and C. dactylon*, 1 nut grass species *i.e., Cyperus rotundus*.

Keywords- Weed, Tomato.

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Introduction

The effort to support tomato crop production development and enhancement to meet the national demand has still faced more obstacles, among others are lack of high quality seed stock production cost increment caused by excessive pesticide and fertilizer application, and organism disturbance included weed which can give rise to yields decrease till to thwart farming yields [1].

Data of Central Bureau of Statistic [2] shows the average increase of harvested area, tomato production and productivity from 2009 until 2013 are consecutively 2,452%, 3,98% and 2,8%. Based on such average growth of tomato harvested area as of 2013 still under standard that is, 2,452%. Consumer demand against tomato hasn't worriedly been able to be equalized by tomato production per year which is still low.

One of factors effecting the decrease of tomato yields both quality and quantity is the weed existence in tomato crop cultivation area. Weed as plant-disturbing organism having the interaction with the plant through the competition to get the growth factor which is the limited availability like light, nutrient, and water. The weed competition with plant depends on rainfall, cultivar, soil condition, weed density, plant age, weed growth, along with plant age when weed begins to compete.

The success in weed controlling must be based with adequate and good knowledge from such a biologically weed nature, for example by conducting identification, searching in the literature about such weed references, then, asking the experts or weed expert. The three ways are the first step to determine the way of accurate controlling [3]. The applied weed controlling, cultivated plant type and area topography will decide the diversity and weed dominance which is being in an area.

On the basis of such description is to be necessarily carried out the research about the weed diversity on tomato plant (*Lycopersicum esculentum* Mill) in Majalengka Regency.

Research Method

The research is carried out in farmer-owned horticulture crop area in the region of Majalengka Regency. Research location for tomato planting is in 4 districts, i.e. Argapura District, Banjaran District, Talaga District and Cikijing District. Experiment location is any altitudes, soil type, agro-climate, and on the previously different cultivation. The experiment was conducted in November 2016 as of 2017. The used materials in this experiment are soil map required from each villages, West Java Agro-climate map required from BMKG Majalengka Regency, and experiment material questionnaire required from farmers or local instructor to ease observation. Whereas tools used in this research are squared meters (0,25 m x 0,25 m), scissor, hoe, meter, raffia string, plastic bag, electric scale, and drying oven.

The research uses descriptive research method through survey method. On each district will be selected randomly per tomato plant area as distributed sample in any different altitude condition, however with the age of each plant is not much different, so to get required sample-plot number, firstly determined minimum plot area by making sample-plot curve.

After required sample-plot number is obtained, then can be undertaken weed vegetation analysis diagonally for each of tomato planting area with squared method with its size of 0,25 m x 0,25 m, meanwhile, the questionnaire made to know many things related to its history or background along tomato cultivation practice in survey area.

Response Design

Vegetation analysis is the way to study the composition and vegetation structure or plants colony. Weed vegetation analysis carried out by picking up the weed from destructive plot 1 m^2

And grouped per weed species. Dry weight per species and total measured by means of weighting the dried weed in the oven until reaching constant weight at temperature of 80^0C. furthermore, the counting of weed Importance Value (IV), Summed Dominance Ratio (SDR), weed diversity index, dominance index (D), weed type, and weed species dominance index (D) with following formulas:

a) Weed Importance Value (IV)is value obtained from the calculation:

$$Species\ relative\ density = \frac{Absolutely\ class\ density\ value}{\sum Absolutely\ all\ classes\ density\ value}\ x\ 100\%$$

$$Species\ relative\ frequency = \frac{Absolutely\ class\ frequency\ value}{\sum Absolutely\ all\ classes\ frequency\ value}\ x\ 100\%$$

$$Species\ relative\ Dominance = \frac{Absolutely\ class\ Dominance\ value}{\sum Absolutely\ all\ classes\ Dominance\ value}\ x\ 100\%$$

Weed Importance Value (IV) = Relative Density + Relative Frequency + Relative Dominance

b) Summed Dominance Ratiois useful to describe the relation dominance number of a weed type with the other weed in a community.

$$SDR = \frac{Important\ value}{3}$$

The weed type having biggest SDR value means such weed is dominant weed.

c) Dry weed weight per species, the observation is conducted at the time of vegetation analysis by taking from destructive plot 0,25 m^2 and grouped into three weed classes, i.e. broad weed, grass, nut grass. Dry weight is measured by weighing the dried weed in oven until reaching constant weight at the temperature of 800C.

d) Community coefficient according to [4], can be counted with the formula as follows :

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

Explanation:

W : The number of 2 lowest quantity for the type of each community

a : The number of all quantities on the first community

b : The number of all quantities on the second community

DISCUSSION AND RESULT

Weed Importance Value

According to Kurniawati 2008 [5], say that the relatively high temperature condition, abundant sunlight and adequate rainfall for tropical region stimulates the weed to grow fruitfully. This effects the weed to be the problem in crops cultivation, plantation, horticulture, waters, and non-farming field. It is different to plant - pest and diseases, the effect caused by weed is not directly seen and slow motion. However, the weed can afford to compete strongly in fighting over nutrient, water, sunlight, air, and growth space [6]. Data on the [Table-1] indicates that dominant weed in tomato planting center in Argapura District having the highest importance value is shown by broad-leaved weed species i.e. *Galinsoga parviflora* (76,1%), in Banjaran district and Cikijing District are shown by weed grass species i.e. *Eleusin indica* (74,9% dan 71,6%), in Talaga District is indicated by broad-leaved weed species i.e. *Ageratum conyzoides* (87,2 %).

Summed Dominance Ratio (SDR)

Data on [Table-2] indicates that dominant weed species found in the tomato planting center in Majalengka Regency are 8 species. 5 broad-leaved weeds are recorded: *Galinsoga parviflora, Drymariavillosa, Oxallistrifolia, Ageratum conyzoides and Artemisia vulgaris*, 2 weed grass: *Eleusin indica and Cynodon dactylon* and nut grass *i.e., Cyperus rotundus*

Table-1 *The weed importance value in the tomato planting center in Majalengka Regency*

No.	Name of Species	Important Value			
		Argapura	Banjaran	Talaga	Cikijing
1	*Eleusin indica*	50,2	74,9	69,4	71,6
2	*Galinsoga parviflora*	76,1	65,9	63,5	52,7
3	*Digitaria ciliaris*	11,9	-	-	-
4	*Drymaria villosa*	30,8	-	-	49,2
5	*Lindernia dubia*	7,3	-	-	-
6	*Richardia brasiliensis*	21,2	23,7	4,3	-
7	*Borreria alata*	22,2	-	-	-
8	*Oxalis trifolia*	23,9	62,3	-	29,4
9	*Artemisia vulgaris* L.	8,6	-	30,5	32,7
10	*Cyperus rontundus*	47,1	-	-	-
11	*Setaria palmifolia*	0	-	-	20,1
12	*Oxalis corniculata*	-	21,9	-	-
13	*Cynodon dactylon*	-	51,3	-	-
14	*Erechtites valerianifolia*	-	0	-	-
15	*Altenanthera philoxeroides*	-	-	24,5	-
16	*Eragrostis tenella*	-	-	8,3	-
17	*Sida rhombifolia*	-	-	13,3	-
18	*Ageratum conyzoides*	-	-	87,2	-
19	*Commelina diffusa*	-	-	-	20,6
20	*Erigeron sumatrensis*	-	-	-	14,1
21	*Amaraus timorense*	-	-	-	9,7

Table-2 *Dominant Weed in 4 Tomato planting Field in Majalengka Regency*

No.	Species	Summed Dominance Ratio (SDR) %			
		1	2	3	4
1	*Eleusin indica*	16,7	24,9	23,1	23,9
2	*Galinsoga parviflora*	25,4	21,9	21,2	17,6
3	*Drymaria villosa*	10,3			16,4
4	*Cyperus rotundus*	15,9			
5	*Oxalis trifolia*		20,8		
6	*Cynodon dactylon*		17,1		
7	*Ageratum conyzoides*			29,1	
8	*Artemisia vulgaris*			10,2	10,9
Spesies Gulma Lain		31,7	15,3	16,4	31,2

Explanation: 1 = Argapura District, 2 =Banjaran District, 3 = Talaga District, 4 = Cikijing District

Weed Vegetation growing in a region will be different to the other ones, although with the similar cultivated plant. This is caused by there is the difference of microclimate involving temperature, light intensity, wind, landscape and time (dry and rain season). According to [7], weed species growing and dominating an area depends on local site and climate. According to [8]. Weed growing in an area has good and fertile soil condition then matched to growth requirements, so it will grow fruitfully.

Dry Weed Weight per species and Total

Observation is conducted at the time of vegetation analysis by picking it up from destructive plot 0,25 m^2 and grouped into three weed classes, i.e. broad- leaved, grass, and nut grass. Dry weight is measured by the means of weighing the dried weed in oven until reach constant weight at 80°C. The calculation of dry weight weed per species carried out because of each weed species has the different weight to the others. On [Table-3]. Seen that weed species havin highest dry weight in tomato planting center in Argapura District is *Eleusin indica* (32,4 gr) and lowest dry weight is shown by *Lindernia dubia* (1,5 gr). The highest dry weight in Banjaran District is *Eleusin indica* (20,1 gr) and the lowest dry weight is shown by *Oxalis corniculata* (2,4 gr). The highest dry weight in Talaga District is *Ageratum conyzoides* (80,4 gr), and the lowest dry weight is shown by *Richardia brasiliensis* (0,5 gr). The highest dry weight in Cikijing District is *Artemisia vulgaris* (116,1 gr) and the lowest one is shown by *Amaraus timorense* (2,2 gr). The total dry weight of weed in tomato planting center in Argapura District is 161 gr, dry weight of weed in Banjaran District is 68,6 gr, Dry weight of weed in Talaga District is 222,6 gr and dry weight of weed in Cikijing District is 266,4 gr.

Table-3 *Dry Weight of Weed Per Species and Total In Tomato Planting Center In Majalengka District*.

No.	Species	Dry weight of weed per 0,25 m² (gr)			
	Broad-leaved weed	Argapura	Banjaran	Talaga	Cikijing
1	*Galinsoga parviflora*	58	16,2	51	33,3
2	*Drymaria villosa*	6,6	-	-	30,1
3	*Lindernia*	1,5	-	-	-
4	*Richardia brasiliensis*	8,9	3,4	0,5	-
5	*Borreria alata*	9,7	-	-	-
6	*Oxalis trifolia*	10,6	15,3	-	13,8
7	*Artemisia vulgaris*	2	-	16,6	116,1
8	*Oxalis corniculata*	-	2,4	-	-
9	*Erechtites valerianifolia*	-	0	-	-
10	*Altenanthera philoxeroides*	-	-	10,8	-
11	*Sida rhombifolia*	-	-	4	-
12	*Ageratum conyzoides*	-	-	80,4	-
13	*Commelina diffusa*	-	-	-	7,9
14	*Erigeron sumatrensis*	-	-	-	4,2
	Grass				
15	*Eleusin indica*	32,4	20,1	58	51,4
16	*Digitaria ciliaris*	2,3	-	-	-
17	*Setaria palmifolia*	0	-	-	7,4
18	*Cynodon dactylon*	-	11,2	-	-
19	*Eragrostis tenella*	-	-	1,3	-
20	*Amaraus timorense*	-	-	-	2,2
	Nut Grass				
21	*Cyperus rotundus*	29	-	-	-
	Total	**161**	**68,6**	**222,6**	**266,4**

The Coefficient Of Weed Population Community

According to [4], if C value is greater than 75%, so the weed community among phases compared is not significant or sufficiently uniformed and if C value is smaller than 75%, so weed community among such phases doesn't have the population similarity. On [Table-4] indicates that population community coefficient value on all areas of tomato research under 75%. It indicates that the land of each district in Majalengka District having the high difference level of weed type. The existence of high difference on weed type because of weed species growing in each district in Majalengka Regency are not all growing similarly. The difference of weed type growing in each district in Majalengka Regency is also caused by the difference of planting pattern, planting space, plant varieties and environment condition enabling the weed existence on tomato and carrot in each district in Majalengka Regency is different. Data on [Table-4] indicates that weed population community coefficient value in all research areas under 75%, it means that research area in Argapura District with in Cikijing District not having the same weed population. Type and weed diversity in a land effected by some factors, that is, soil type, technique culture, and altitude

Table-4 *The comparison of weed population community coefficient value from both researched plant in Majalengka Regency.*

No.	Tomato		Carrot	
	Research Area	C (%)	Research Area	C (%)
1	A:B	53,7	A:B	48,96
2	A:C	42,4		
3	A:D	55,4		
4	B:C	45,7		
5	B:D	51,1		
6	C:D	50,9		

Conclusion

The result indicates that weed species existing in tomato planting center in Majalengka Regency are 21 species. 14 broadleaved weed species are recorded, 6 grass species and 1 nut grass. Dominant weed species found in tomato planting center in Majalengka Regency are 8 species. 5 broad-leaved weed species are recorded, *i.e., G. parviflora, D. villosa, O. trifolia, A. conyzoides and A. vulgaris,* 2 grass species, *i.e., E. indica and C. dactylon,* and 1 nut grass species, *i.e., Cyperus rotundus.*

Application of research: Weeds are one of the factors that can decrease the yield of tomato plants. To avoid losses due to the presence of weeds it is necessary to control weeds. Weed control can be effective and efficient if we know the target weed species. This study shows the dominant weed species in tomato crops.

Abbreviations:

IV = Importance Value
SDR = Summed Dominance Ratio

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