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Diversity and Prediction of Corn Product Loss Due Weed Competition to Two Types of Dry Land Agroecosystem

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Abstract: The aim of the study was to determine which weed species had a significant effect on the reduction of maize yields, so that it could be determined which species should be controlled and which should not be controlled. The research was carried out using a descriptive method on dry land in Mumbul Sari Village, Bayan, North Lombok. Collecting data on population and growth of weeds and plants, using sample plots measuring 1 m2 placed at 10 points by random sampling. Parameters observed were weed species population, corn crop population plot^{-1}, dry biomass weight of plot^{-1} weed, dry biomass weight of plot^{-1} corn, and dry seed weight of corn plot^{-1}. Quantitative data analysis by calculating the value, relative density (RN), relative frequency (RF) and relative dominance (RD) to calculate the significant value index (SVI), and Summe Diminance Ratio (SDR). There were 2 species of puzzle weed, 10 species of Poaceae weed and 13 species of broadleaf weed. One species of puzzle weed, namely *Cyperus rotondus* and 3 species of Poaceae *Digitaria longiflora*, *Paspalum conjugatum* and *Panicum repens*, and 2 species of broadleaf weed, *Amaranthus spp*., and *Synedrella nodiliflora*, were very dominant and continued to exist during plant growth with respective SDR values each species 10.43%; 15.37%; 10.20%; 9.67 %; 10.00% and 5.80%. The competitiveness and relative weighted dominance of the 6 weed species were higher than other weed species, so that the six weed species were able to eliminate the average maize yield since the plants were 30 – 90 as much as 17.90%; 16.78%; 12.35%;10.88%; 9.18% and 3.40%.

Keywords: Weeds; Yield loss; Competition; Poaceae; Puzzles

Introduction

Corn is the second staple food commodity in Indonesia, which is widely cultivated by farmers after rice. Since 2008 nationally there has been a significant increase in corn planted area and production compared to previous years. In 2008, national corn production only reached 14.614 million tons and in 2013 national corn production increased to 18.51 million tons. On the basis of the national development of corn production, the Provincial Government of West Nusa Tenggara (NTB) has designated corn as a leading program for development in regional agriculture. This policy is the right step because in addition to having regional potential (land potential) that is quite capable, corn is a plant that is quite easy to cultivate, resistant to drought stress, does not require too much water, and is more resistant to pests and diseases (BPS Propoinsi NTB, 2013; Ngawit et al., 2021).

Since 2008 until the last few years, corn production in NTB has increased quite significantly, namely an average of 35% year-1. Corn production in the province of NTB in 2008 only reached 196.237 tonnes. Then in 2013 it showed a significant increasing trend, namely 642,674 tons and in 2018 it reached 874.34 tons. The increase in maize yields was quite high, in addition to the increase in the area planted, it was also obtained from the contribution of increased crop productivity which reached an average of 5.4 tons ha-1 (BPS Province of West Nusa Tenggara, 2013; BPS, 2020).

However, the average corn production of 5.4 tons ha-1 achieved in the NTB region is still lacking, considering that nationally the average maize

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production can reach 7.64 tons ha-1 (Syafruddin and Saidah, 2006). The low average corn production in NTB compared to the national average is thought to be related to the quality of the growing environment and the varieties planted. This is due to the influence of the interaction between plant genotypes and the environment. Many factors determine the optimal productivity of corn yields, such as soil fertility and climate. In general, climate, especially temperature, rainfall, and sunlight intensity determine the growth of corn plants. From the climate aspect, almost all regions in Indonesia are suitable for producing corn. The availability of soil nutrients for the growth of corn plants also determines the success of corn cultivation. Another important factor affecting the productivity of corn is the presence of weeds (Syafruddin and Saidah, 2006; Aqil et al., 2007; Ahmed et al., 2011).

Weeds are nuisance organisms whose presence in the corn planting area not only causes crop yield losses but also reduces seed quality. The reduction in crop yield due to competition with weeds is highly dependent on the type of weeds, density, and duration of competition caused by weeds. Under normal conditions if control is not carried out, yield losses caused by weeds exceed yield losses caused by pests and diseases (Blum et al., 2000; Asroh et al., 2015). The level of problems caused by weeds in corn plants varies quite a lot, depending on soil type, temperature, altitude, planting method, water management, and weed control techniques. Corn plants tend to produce high when weed free during growth (Ngawit, 2008). In general, weeds found in corn plants are grouped into three groups, namely the sedge, grass and broadleaf groups (Joni & Darmadi, 2013). Each group has different characters, both in terms of morphology and ecology. Although the poaceae, sedge and broadleaf weeds have similarities in several respects, each species has different morphological and ecological characteristics. With that difference, it may be that the approach to control is also different (Charta et al., 2013). However, until now there has been no official report on which species caused the most damage and reduced yields to corn plants. Therefore, research has been carried out whose main objective is to determine the diversity of weed species in corn plantations and the reduction of yield loss due to competition for each of these weed species in two types of dry land agroecosystems.

Method

Methods of Research Tools and Materials

The research method used is descriptive method with direct observation of research objects in the field. The research was conducted in Mumbul Sari Village, Bayan District, North Lombok Regency, West Nusa Tenggara Province. The research will be carried out from March 2022 to September 2022.

The tools used in this study were hoes, sickles, knives, chopsticks, analytical scales, tape measure or ruler, scissors, buckets, plastic trays, paper envelopes, bamboo, wooden planks, rapia dance, cameras, and stationery and other supporting tools. . While the materials used in this study were Bisi-18 Hybrid Corn seeds, Urea, TSP and ZK fertilizers and Solid Organic Fertilizers.

Data Collection Techniques in the Field

Data collection in the field was carried out using survey techniques by direct observation of weed populations and corn plants. Data collection began at 31 days after tillage or when the corn plants were 30 DAP. Subsequent observations were made every 15 days until the plants were 90 DAP. The sample plots were placed systematically by random sampling with a diagonal line across the entire area of the maize plots, regardless of the condition of the weed population at the study site. Sample plots were placed at 10 different points with a size of 1 m x 1 m. Because each observation was carried out by taking weeds and corn plants constructively, the points of the sample plots for further monitoring were moved to areas of the plants that were still intact. Weed species found in each sample plot through visual observation of their populations were counted and each type was used as a herbarium for further identification (Melati, 2008; Ngawit & Budianto, 2011).

Research Implementation

Tillage is carried out to improve drainage, level the soil surface and clean the soil from the remains of plant organs, so that a suitable and loose layer is obtained for maize cultivation. Tillage is carried out at a minimum with one plow and one rake and leveled. Then made three (3) beds measuring 5 m wide and 25 m long, with a bed height of 30 cm. The distance between the beds is 50 cm. Land preparation was carried out 3 days before planting to improve air conditioning and soil aeration.

Basic fertilization is carried out after the completion of making the beds with fertilizer P 150 kg ha-1, K 150 kg ha-1, N with a dose of 250 kg ha-1, specifically N fertilizer is applied ½ dose as basic fertilizer and the rest as supplementary fertilizer after the plants are 21 DAP. Organic fertilizers use cow manure which is applied during land preparation at a dose of 30 tons ha-1. Planting was done with a spacing of 75 x 25 cm, 2 seeds per hole. When planting the seeds, add the basic fertilizer at a distance of 5 cm from the seed shovel.

Irrigation is done in a leb method, when the soil condition is close to dry with temporary wilting, which is determined visually during the day the plant leaves seem to wither but, in the afternoon, they appear fresh again. Weeding is not done; all types of weeds are allowed to grow while the corn plants grow. Pest and disease control is carried out when there are symptoms of attack by chemical means that are adapted to the types of pests and diseases that exist.

The parameters observed included the number of weed species/species, the total population of each weed species, the total population of maize plant plot-1, the weight of dry weed biomass, the weight of dry plant biomass, and the weight of dry corn husks plot-1. Observations were made when the plants were 30 days old for 90 days with an interval of 15 days.

Data analysis

Data analysis was carried out using quantitative analysis of several parameters namely, Relative Density (KR), Relative Frequency (FR) and Relative Dominance (DR) which are incorporated in the Important Value Index (INP), and Standard Dominance Ratio (SDR). Significance values and SDR are then very useful in analyzing and calculating several indices/criteria for vegetation properties. The similarity index, which is often called the community coefficient value, is used to assess the variation or similarity of various weed communities in an area. weed community coefficient (C) calculated by the formula (Syahputra et al., 2011):

$$C = \frac{2W}{a+b} x100\% \quad (1)$$

Note:
C = Community coefficient (%),
W = The lower (smaller) SDR of each pair of weed species from the two communities being compared,
a = Number of SDRs of all species in the first community,
b = Number of SDRs of all species in the second community.

Indeks keanekaragaman jenis (H') adalah parameter yang sangat berguna untuk membandingkan dua komunitas, terutama untuk mempelajari pengaruh gangguan biotik, untuk mengetahui tingkatan suksesi atau kestabilan suatu komunitas. Perhitungan H' didapat dari data nilai penting pada analisis vegetasi, dengan rumus sebagai berikut (Syahputra *et al.*, 2011):

$$H' = -\sum_{n=1}^{n} \left(\frac{ni}{N}\right) \left(\text{Ln } \frac{ni}{N}\right) \quad (2)$$

Note:
H' = Shannon-Wiener diversity index
ni = The number of important values / SDR of a species
N = Total significant value/SDR of all types
Ln = Natural logarithms (natural numbers)

Criteria: H' < 1 = low species diversity; 1 ≤ H' ≤ 3 = moderate species diversity; H' > 3 = high species diversity.

Species evenness index to find out whether each weed type has the same number of individuals. Maximum evenness of species when each type of population or the number of individuals is the same. The type evenness index formula is as follows (Suveltri et al., 2014):

$$E = \frac{H'}{H'_{max}} \quad (3)$$

Note:
E = evenness index; H' = Shanon-wiener diversity index
H'max = log2 S (S is the number of weed species)
The criteria for evenness values are used: E > 0.6 = high evenness, 0.3 ≤ E ≤ 0.6 = moderate evenness, and E < 0.3 = low evenness.

The species dominance index is used to determine species richness and the balance of the number of individuals of each species in an ecosystem. To determine the dominance index value, the following Simpson formula is used (Suveltri et al., 2014):

$$C_i = \sum_{n=1}^{n} \frac{n_i}{N} \quad (4)$$

Note:
C = Dominance index
ni = The importance of a nth species
N = Total importance values of all species

The criteria for the results of the species dominance index, namely 0 < Ci < 0.5 means that there are no dominant species, and 0.5 < Ci < 1 means that there are dominant species.

Data biomas kering dari gulma dominan yang diperoleh pada setiap perlakuan ditarik regresi dengan hasil nyata (*yield*) tanaman utama (jagung) sebagai variabel terikat dengan berat biomas kering dan populasi gulma dominan sebagai variabel bebas sehingga diperoleh model persamaan regresi sebagai berikut:

$$Y = \beta_0 + \beta_{1i} B_i + \beta_{2i} P_i + \ldots\ldots + \beta_{1n} B_n + \beta_{2n} P_n \quad (5)$$

Where, Y is the real yield variable for corn, β_0 is constant, β_1 is the regression coefficient, Bin is the weight of weed biomass from type-i to type-n, Pin n weed population is type i to type n. The independent variable regression coefficient can be considered as the value of weed competition to the main crop variables. The value of the predictive variable for the effect of weeds on the main crop Y(MDT) is the estimated value of Y which is obtained by inserting the observed Bi and Pi values into the regression equation. The regression coefficient of the independent variable can be considered as the value of weed competition on the main crop variable. The value of the predictive variable for the effect of weeds on the main crop Y(DMT) is the estimated Y value obtained by inserting the observed Bi and Pi values into the regression equation (1). In this article, the value of Y(DTM) is determined by calculating the weight value of weed and plant biomass multiplied by the total population divided by the number of sample plots. In detail, the absolute weighted dominance (DTM) and relative (DTN) values of plants and weeds can be stated as follows (Ngawit et al., 2021):

$$DTM = \frac{\text{(Plant biomass weight to} - \text{n) (plant population to} - \text{n)}}{\text{Number of Sample Plots}} x100\% \quad (6)$$

$$DTN = \frac{\text{Weighted dominance value of a plant species}}{\text{Total weighted dominance value of all plant species}} x100\% \quad (7)$$

This relative weighted dominant value can replace the weed population variable in the linear relationship model between dry biomass weight (plant yield) and weed population, to calculate the competition index for each type or group of weeds with the following formula (Ngawit, 2008):

$$q = \frac{\beta_1}{\beta_0} \quad (8)$$

Note:
q = weed competition index
β_0 = constant
β_1 = regression coefficient variable weight of dry weed biomass

Furthermore, to predict maize yield loss due to competition for each species or group of weeds, an empirical model is applied to the data by using weed-free maize real yield (corn dry biomass weight) as the dependent variable and weed-weighted dominance value (DTN) as the independent variable. so we get a combination of empirical models, modified from the model according to (Kropff and Lotz, 1993):

$$YL = DTN_t \ \beta_1 \sqrt{DTNg} \quad (8)$$

Note:
YL = prediction of maize yield loss
β_1 = weed competition index
DTN_g = weighted dominance relative to weeds
DTN_t = weighted dominance relative to weed-free plants.

Result and Discussion

Populasi dan Pertumbuhan Gulma pada Jagung di Dua Tipe Agroekosistem Lahan Kering

Observation of weed populations was carried out on two types of dry land agro-ecosystems, namely type one (I) dry land which only relies on rainfall and limited irrigation, and type two (II) dry land which already has groundwater irrigation facilities with drilled wells. The population and growth of weed species in the two types of agroecosystems were not significantly different, based on the similarity index value between type I and II agroecosystems with a similarity index value of 84.42% and a difference value of only 15.58%. Ngawit et al. (2021), stated that the similarity index value was less than 75% of the two vegetation communities which were compared significantly. Conversely, if the similarity index value is greater than 75%, the two vegetation communities being compared are not significant.

Based on the analysis of total dominance relative values (SDR) of 25 weed species found, 1 species of puzzle weed, 8 species of grass weeds and 5 broadleaf weeds whose dominance was stable throughout the life of the plant. So only 14 species of weeds were always found in the sample plots during the age of the plants, while the remaining 11 species were found in very small populations, sporadically and after 45 DAP the corn was no longer found in the study sample plots.

The data in Table 1. shows that when the plants were 30 DAP and 45 DAP, six weed species were found to be very dominant and eight species were dominant. However, after the plants were 45 DAP, the dominance of several weed species began to decline even after the plants were 75-90 DAP, only 6 weed species remained dominant, 3 species of grasses, 1 species of sedge and 2 species of broadleaf weeds. While the other 8 species were very sporadic and were no longer found in the observation sample plots. Six species of weeds that remain dominant and exist until the harvesting age of the corn plant are Digitaria longiflora (Retz.) Koe., Paspalum conjugatum Bergrn., Panicum repens L., Cyperus rotundus L., Amaranthus spp. and Synedrella nodiliflora L. (Table 1). This finding is in accordance with the results of the calculation of the similarity index value (C), that there is a shift in population, dominance and growth of weed species in line with the increasing age of the corn plant. Weed population and growth at the age of 30.45 and 60 DAP were not significantly different, with a similarity index value of more than 75% and a difference of less than 25%. However, weed population and growth at 30 DAP were significantly different from weed population and growth at 75 DAP and 90 DAP (Table 2).

Table 1. SDR value (%) of each weed species and corn plants at the age of 30, 45, 60, 75 and 90 (DAP)

Vegetation species	Plant Age (DAP)				
	30	45	60	75	90
D. longiflora (Retz.) Koel.	9.80	12.94	16.69	19.07	18.36
P. conjugatum Bergrn.	8.40	8.97	15.14	15.46	12.93
Panicum repens L.	8.00	8.86	12.78	15.43	11.30
Cyperus rotundus L.	7.65	8.77	11.41	12.37	11.94
Amaranthus spp.	8.20	9.34	10.45	10.09	11.91
Synedrella nodiliflora L.	6.45	8.41	9.54	2.36	2.19
Leersia hexandra Sw.	5.40	6.22	2.64	0.00	0.00
Eleusine indica (L.) Gaena.	4.96	5.85	2.10	0.00	0.00
Cynodon dactylon L.	4.98	5.24	1.89	0.00	0.00
Echinochloa colonum L.	7.32	5.12	0.85	0.00	0.00
Brachiaria reptans L. G& H	4.82	4.09	1.01	0.00	0.00
A. compressus (Swartz.) B.	6.14	3.40	1.50	0.00	0.00
Imperata cylindrica L.	4.88	2.95	0.84	0.00	0.00
Ageratum conyzoides L.	7.70	3.51	2.14	1.71	1.73
Zea mays L.	5.66	6.32	11.06	23.52	29.64
Total	100.00	100.00	100.00	100.00	100.00

Table 2. The similarity index value (%) of the weed population at each age of the corn plant

The ages of the plants being compared	Similarity index value (%)	Similarity (%)	Difference (%)
30 vs 45	88.57	89.00	11.43 ns*/
30 vs 60	67.13	67.00	32.87 s
30 vs 75	51.81	52.00	48.19 s
30 vs 90	51.66	52.00	48.34 s
45 vs 60	76.58	77.00	23.42 ns
45 vs 75	59.27	59.00	40.73 s
45 vs 90	59.12	59.00	40.88 s
60 vs 75	81.24	81.00	18.24 ns
60 vs 90	77.66	78.00	22.34 ns
75 vs 90	92.06	92.00	9.11 ns

*/ A difference of more than 25% is significant and a similarity of more than 75% is not significant.

Hilwan et al. (2012), stated that during the plant age phase of 30 - 45 DAP the number of species and populations of each weed species varied greatly and the population number decreased during the plant age phase of 75 - 90 DAP. Because in the young plant age phase there is still enough light available for weed growth. After the age of 60 DAP, the corn canopy began to close to each other, so that the population and growth of several weed species were suppressed as a result of which some of them were no longer found in the observation plots.

Six species of weeds that remain dominant and exist during the growth of corn plants because of their high adaptability and aggressiveness, can grow in extreme conditions, spread widely, have strong roots and reproduce by seeds, stolen and rhizomes. This statement is in accordance with the results of the calculation of the index of diversity, evenness, abundance and dominance of weed species. The diversity of weed species that grew on corn plants from the initial phase of growth until before harvest was in the moderate category because the highest was found when the plants were 30 DAP, which was 2.6597 and the lowest was when the plants were 75 DAP, which was 1.6072 (Table 4). Ngawit et al. (2021), stated that the value of H' < 1 = low species diversity, 1 ≤ H' ≤ 3 = moderate species diversity, and H' > 3 = high species diversity. Medium diversity of weed species since the corn plants were 30 DAP according to Syahputra et al. (2011), because the breeding organs of several weed species were still dormant at the beginning of plant growth, after 30 DAP they had started to grow due to tillage, fertilization and irrigation treatments, and supported by wide enough corn spacing, causing various types/species of weeds. easy to grow. As a result, the entire area of the corn plant is overgrown with various types/species of weeds evenly. This statement is supported by the results of the evenness index (E) calculation which is included in the high category since the plants were 30 - 90 DAP with a value obtained greater than 0.5, which means that the ability to spread evenly each weed species is high (Table 3).

Table 3. Index values of diversity, evenness, dominance and abundance of weed species in each phase of plant age

Plant Age (DAP)	H'	E	C_i	D_i
30	2.6597	0.9821	0.7331	6.6667
45	2.5453	0.9400	0.0863	6.6667
60	2.0815	0.7686	0.1369	6.5072
75	1.6072	0.5935	0.8866	12.4040
90	1.7829	0.6548	0.1842	12.5000

Note: H' = species diversity index, E = species evenness index, Ci = species dominance index and Di = species abundance/distribution index.

The weed dominance index value obtained during plant growth is also high because it is greater than 0.1, this means that there are several types of weeds that are dominant during plant growth (Adriadi et al., 2012). The existence of a dominant species was also indicated by the species abundance index which was quite high when the plants were 30-60 DAP, namely 6.5 - 6.7 then increased when the plants were 75 -90 DAP, namely 12.4 - 12.5 (Table 3). So it can be stated that there are several weed species whose ability to spread or overflow throughout the corn planting area is high, especially after the plants are 75 – 90 DAP so that they continue to exist and are dominant until the time for harvesting the crops.

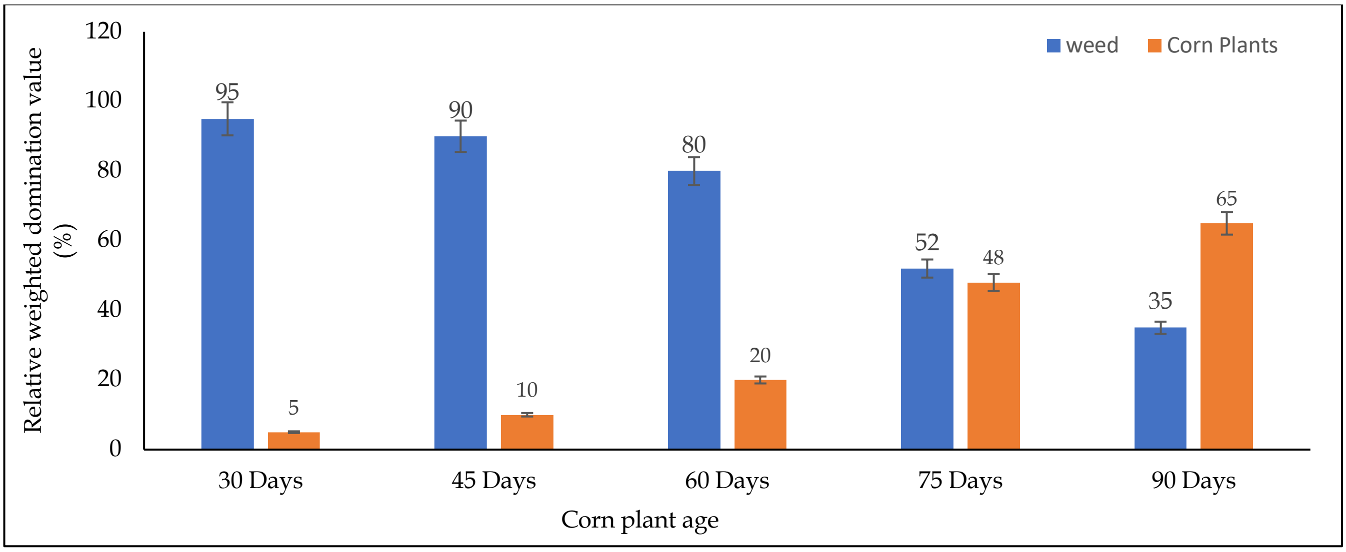
Prediction of Corn Yield Loss Due to Weed Competition

Corn yield loss due to weed competition has occurred since the beginning of its growth (30 DAP) as much as 11.52%, then increased sharply at the age of 45 DAP - 60 DAP as much as 91.13 - 97.75% and at the age of the plant 75 DAP - 90 DAP again decreased slightly to 80.34% - 86.12% (Table 7). At the peak of plant vegetative growth activity, 3 species of grassy weeds, namely Digitaria longiflora (Retz.) Koe., Paspalum conjugatum Bergrn., and Panicum repens L., were each able to reduce maize yields 17.32 - 26.48 %; 20.53 – 20.83 %; and 17.00 – 21.01 %. Meanwhile, the other 7 species of weeds have the ability to reduce corn yields by less than 1%. Cyperus rotundus L. weeds were able to reduce maize yields from 8.21 to 15.64%. Two species of broadleaf weeds, Synedrella nodiliflora L. and Amaranthus spp, were able to reduce maize yields by 7.54–7.82% and 7.66-9.50%, respectively. The greater ability of the 6 weed species to reduce maize yields was due to the competitiveness (competition index) and dominance of the 6 weed species being higher than the other 8 weed species. So it can be stated that the six sugar species have the highest ability to dominate and dominate the growing media in the corn crop area. The characteristics of the six weed species are their ability to spread widely, aggressively and difficult to control. Based on the dominance and abundance index values, Digitaria longiflora (Retz.) Koe., Paspalum conjugatum Bergrn., Panicum repens L. and Cyperus rotundus L. are classified as malignant weeds. This species uses the C4 primary metabolic pathway, which means it is able to grow well under conditions of stress, heat and low light (Asroh et al., 2015). Its regenerative capacity and seed dispersal also contribute to its competitive advantage. Joni & Darmadi (2011), stated that the Poaceae and teki families, are weeds that have high adaptability, can grow in extreme conditions because they are vicious weeds, spread widely, have strong roots and reproduce by seeds, stolen, rhizomes and tubers. . As a result, these weeds can control the space where they grow and excel in competition with corn plants. Rusdi et al. (2019), also reported that weeds Amaranthus spp., Synedrella nodiliflora L, and Ageratum conyzoides L., have the ability to dominate the corn planting area superior to other broadleaf weed species, due to their high adaptability and aggressiveness.

Table 4. Prediction of corn yield loss (YL) due to weed competition since the corn plants were 30, 45, 60, 75 and 90 DAP

Weed species	Loss of crop yields [YL (%)]				
	30 DAP	45 DAP	60 DAP	75 DAP	90 DAP
D. longiflora (Retz.) Koel.	1.3625	26.477	17.324	21.6424	22.7004
P. conjugatum Bergrn.	1.3982	20.530	20.832	17.6900	23.4563
Panicum repens L.	1.0231	21.009	17.000	14.5957	8.1200
Cyperus rotundus L.	1.2480	8.208	15.637	13.9460	15.3500
Amaranthus spp.	1.1782	7.656	9.461	11.5267	16.0550
Synedrella nodiliflora L.	0.7443	7.821	7.540	0.6000	0.3000
Leersia hexandra Sw.	0.5100	1.671	0.342	0.0000	0.0000
Eleusine indica (L.) Gaena.	0.4693	0.839	0.650	0.0000	0.0000
Cynodon dactylon L.	0.3847	1.039	0.700	0.0000	0.0000
Echinochloa colonum L.	1.0004	0.615	0.228	0.0000	0.0000
Brachiaria reptans L. G& H	0.3654	0.714	0.330	0.0000	0.0000
A. compressus (Swartz.) B.	0.4500	0.434	0.230	0.0000	0.0000
Imperata cylindrica L.	0.8500	0.300	0.350	0.0000	0.0000
Ageratum conyzoides L.	0.5400	0.434	0.503	0.3410	0.1400
Total	11.5241	97.747	91.127	80.3418	86.1217

The amount of maize yield loss due to the competition of the six dominant weed species is highly dependent on the relative weighted dominance value and the competition index of each weed species. The data in Figure 1 shows that the total value of weighted relative dominance (DTN) for weeds at the age of 30 DAP is high, while the DTN value for corn is low. The DTN value of weeds decreased with increasing age of the plant, on the other hand the DTN value of corn plants increased. When the plants are 75-90 DAP, the weed DTN value is very low, only 15-18%, so that the DTN value for corn can reach 82-85%. Weed species that contribute to a high decrease in DTN values with increasing plant age are L. hexandra Sw., E. indica (L.) Gaena., C. dactylon L., E. colonum L., B. reptans L. G & H., A. compressus (Swartz.) B., Imperata cylindrica L. and A. conyzoides L. (Fig. 1).



Gambar 1. Comparison of DTN values (%) between weeds and corn plants from the age of the plants 30 -90 DAP

It seems that the DTN value of each weed species decreases with increasing age of the plant, in fact it also has an impact on the ability of weeds to reduce crop yields. The data in Figure 2 shows that the yield loss of corn plants decreases as the plant ages. When the plants were 75 – 90 DAP, the maize yield loss due to competition from *Echinochloa colonum L., Leersia hexandra Sw., Cynodon dactylon L., and Ageratum conyzoides L.,* was very low. The cause is thought to be because this weed species is an annual weed and cannot stand extreme shade. Dominant when the corn plants are young 21 - 35 DAP and after the plants are 45 DAP they are rarely found in the observation sample plots (Ngawit et al., 2021). A denser corn canopy can suppress weed growth because the intensity of sunlight entering between the rows of corn plants is less (Suveltri et al., 2014).

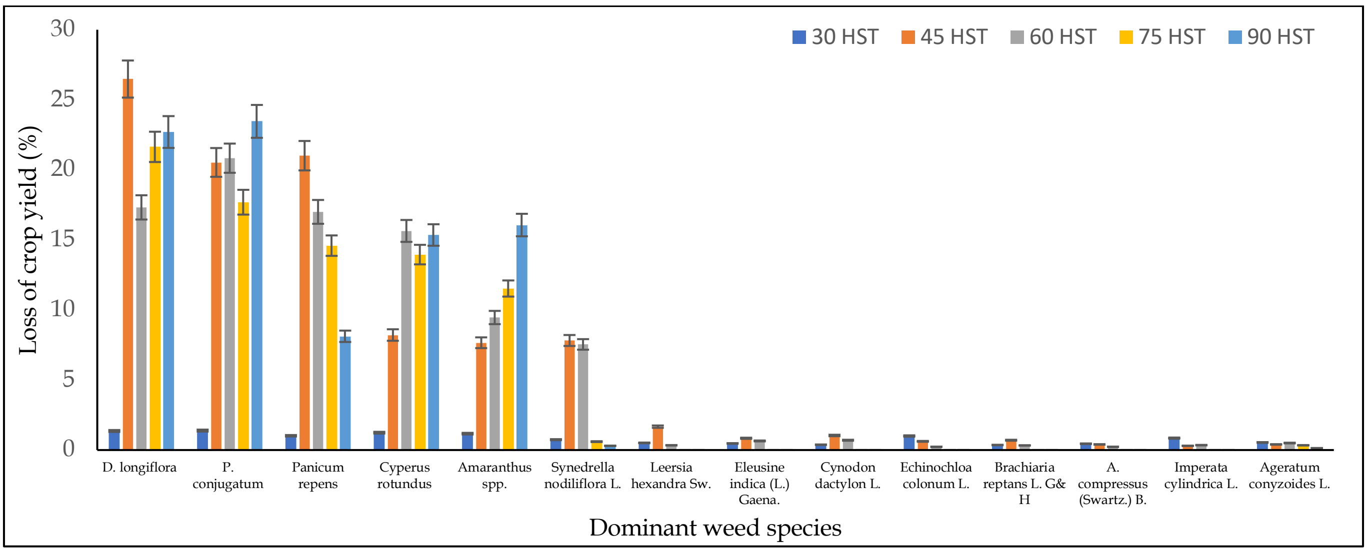


Figure 2. Kehilangan hasil tanaman jagung akibat berkompetisi dengan beberapa spesies gulma sejak berumur 30–90 DAP

According to Carolina (2007), the wider plant canopy covers the planting area and is able to inhibit the intensity of sunlight that escapes to the soil surface by less than 30%, causing the growth of annual weeds to be depressed. As the plants get older, annual weeds from the families of grasses and sedges begin to grow, as a result the growth of annual weeds is depressed because they are unable to compete. Sari et al. (2016), and Muhammad (2021), reported that early in the growth of soft weeds and broadleaf corn plants grow early with low competitiveness. So that the corn plants maximally utilize the available nutrients, water, light, CO2 and growing space. Under these conditions, the role of broadleaf weeds can suppress the growth and population of grasses and puzzles weeds. Also reported by Hardiman et al. (2013), that if allowed to grow ceplukan weeds (Physalis longifolia) and purslane (Portulaca olarceae) if allowed to grow on corn plants, they can suppress the growth and population of vicious weeds from the puzzle and grass groups. The presence of several weed species is not always detrimental to plants. The presence of annual weeds, especially from the broadleaf group, at the beginning of the plant life cycle and in the period before harvest has very little effect, so it does not need to be controlled (Sukman & Yakup, 2002).

Conclusion

In dry land agroecosystem type I, 2 species of sedge weeds, 10 species of grasses and 11 species of broadleaf were found. In dryland agroecosystem type II the number of species of nuts and grasses is the same but there are additional 2 species of broadleaf weeds namely, Ageratum houstonianum and Phyllanthus amarus. After the land was planted with corn, 10 species of grass weeds were found with moderate species diversity, evenness, dominance and high distribution. A sedge species with moderate diversity and evenness but high dominance and distribution. Three species of broadleaf weeds with diversity, evenness, ability to dominate and spread in medium maize areas. Weeds Cyperus rotundus L., Digitaria longiflora (Retz.) Koe., Paspalum conjugatum Bergrn., Panicum repens L., Amaranthus spp., and Synedrella nodiliflora L., were very dominant and continued to exist during plant growth with their respective SDR values 10.43%; 15.37%; 10.20 %; 9.67 %; 10.00 % and 5.80 %. Its competitiveness and dominance are higher than other weed species, so it can reduce the average corn yield during crop growth by 17.90%; 16.78 %; 12.35%;10.88%; 9.18 % and 3.40 %. It is recommended that weeds Digitaria longiflora (Retz.) Koe., Paspalum conjugatum Bergrn., Panicum repens L. and Cyperus rotundus L., Synedrella nodiliflora L., Amaranthus viridis L., and Amaranthus spinosus L., are controlled from the start of plant growth because they are the highest contribution to the loss of maize yields.

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