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GROWTH AND YIELD OF SHALLOTS PLANTED BETWEEN CHILI PLANTS

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ABSTRACT

Community needs for the shallot commodity take place regularly every day because it is a food flavoring ingredient. For this reason, it needs to be followed by the availability of production supplies that are in accordance with consumer needs. Sigi Regency is one of the centers of shallot and chili production in Central Sulawesi, so far it has not been able to make a real contribution in meeting the needs of the community which tends to increase. This is because the exploitation of shallots and chillies is still monoculture, so the risk of crop failure, production decline and farmers' losses is very high. This research was carried out with the aim to determine the growth and yield of shallots planted with various cropping patterns mong chillies, so that information on suitable cropping patterns can be obtained to ensure the availability of high yields of shallots and chillies to meet community needs. The results showed that (i) various shallot cropping patterns among chilli plants did not significantly affect the greenness of leaves, tuber length, fresh weight per tuber, fresh weight of tuber per clump, harvest index and moisture content of shallot bulbs; (ii) leaf length, harvest age and fresh tuber weight of onion bulbs per hectare planted with different cropping patterns among chilli plants were not significantly different, except with monoculture shallot cropping patterns obtained by longer leaves, shorter harvest age (62.0 days) and the weight of fresh bulbs per hectare is higher (1.83 t / ha) compared to various shallot cropping patterns among chilli plants.

Keywodrs: Cropping Patterns, Chillies, Shallots.

INTRODUCTION

Shallot and chili are horticultural commodities that are very popular in Indonesia, because besides being cultivated by many farmers, they often cause price fluctuations for the community.(Mariyono and Sumarno 2015; Bhattarai and Mariyono 2016) This is due to the increasing price of shallots which are not in line with the increase in people's income. Based on data from the Ministry of Agriculture (2016) the harvested shallot area has reached 148,434 ha, but the productivity of shallots in Central Sulawesi is still very low (3.37-5.31 tons/ha) compared to national productivity that has reached (9.66–10,22 tons/ha). The low productivity of shallots in Central Sulawesi, mainly due to the application of cultivation techniques that have not been optimal. In contrast, the planting area and harvest area and chilli production in Central Sulawesi in the 2012-2015 period were still low, but in 2016 the harvested area and chilli production experienced a very large surge with growth reaching 591.61%, due to the UPSUS Pajale-program Babe (Special efforts to increase rice, corn, soybean and red onion and chilli production) from the Ministry of Agriculture of the Republic of Indonesia, especially in production centers throughout Indonesia.

The main problem that often causes volatility in the market is because the demand for shallots and chilli is evenly distributed at all times, while the production

of shallots and chilli is seasonal. (Suwarsinah et al. 2018; Universitas Sebelas Maret,Indonesia et al. 2018) This condition causes turmoil because of the gap between supply and demand, thus causing turmoil between times and between regions. For this reason, efforts and strategies are needed so that the scarcity of production can be overcome, so that price fluctuations can be overcome. One of the efforts that can be developed is by engineering the shallot cropping pattern that is integrated with chili cultivation.(Hardiansyah, Sulistyaningsih, and Putra 2017; Gagopale and Gesine 2015) The application of an integrated cropping system with a pattern of integration between shallots and chilli plants in one common plot of land at the same or almost the same time can be a solution and strategy to maintain the stability of farming production. (Mariyono and Sumarno 2015; Sricharoen et al. 2017) Multiple cropping system is an agricultural business to get more than one crop yield from one species or several types of plants on the same plot of land in one year (Li and Li 2019; Hong et al. 2019). The results of Girsang's study (2008) showed intercropping shallot with red chili 42 days after planting shallots yielding the wet harvest weight of the highest red onion tubers which was 74.29 g tan^{-1}, intercropping with red chili 21 days after planting red chili was 62, 83 g tan^{-1} and intercropping with red chili when planting shallots were 62.11 g tan^{-1} (lowest), while the highest red chilli harvest was in the intercropping system of red chillies planted together with the planting of shallots. This study aims to determine the growth and yield of shallots planted between red chili plants.

MATERIALS AND METHODS

The research was conducted for 6 (six) months starting from the preparation stage to the preparation of the report, namely in June-November 2018. The research location was the center of shallot and chilli production in Sidera Village, Kec. Sigi-Biromaru Kab. Sigi Central Sulawesi.

This study was compiled using a Randomized Complete Block Design (RCBD) repeated three times. Treatment is Cropping Pattern, consisting of: (P1) single cropping pattern, shallot, (P3) stripping pattern 1:1 (1 row onion and 1 chili line), (P4) pattern stripping plant 2:1 (2 rows of shallots and 1 row chilli), (P5) stripping pattern 3:1 (3 rows of shallots and 1 row chilli), (P6) sigzak cropping pattern (shallots planted sigzak between plants chili, (P7) cropping pattern mixed with shallots and chillies (spacing of irregular onions and chillies).

The size of the bed is 210 cm wide x 350 cm long x 25 cm high. The distance between treatment beds is 50 cm and the distance between replications is 75 cm. Monoculture spacing of shallots and chilies is 15x15 cm and 75x40 cm respectively, while the spacing for other cropping patterns is adjusted for each treatment(Kato et al. 2016; Schwinn et al. 2016)

Each chilli hole is planted with 1 chilli plant which is 30 days old after seedling or has leaves of 2-4 pairs, while for shallots planted 1 bulb of onion for each hole. The shallot bulbs that will be planted previously have been sterilized by mixing the seeds with a solution of fungicide(Sopha et al. 2017; Nawab et al. 2018)

In each trial plot, organic fertilizer from a 15 t/ha goat manure as basic fertilizer was given. Giving inorganic fertilizer in the form of NPK (15:15:15) as much as 200 kg/ha is done when the plants are 1 (one) week after planting in the experimental plot. Subsequent fertilization was carried out when the onion plant was 30 days after planting (dap) consisting of 100 kg ZA/Ha and 100 kg KCl/Ha. To obtain a good growth and yield of shallots, biourine liquid organic fertilizer (POC) is given 20 - 40 ml/liter of water (Ansar et al., 2014).

To find out the effect of the treatment being tried, it was observed the growth and yield of the shallots planted between chili plants, as follows: (a) growth components include: leaf length and leaf greenery, observed from 5 (five) sample

plants at each trial plots, and (b) yield components include: harvest age, tuber length, fresh weight per tuber, fresh weight of tubers with leaves per clump, tuber yield with leaves per hectare, tuber moisture content and harvest index calculated according to Khandakar (1994) . Data were analyzed using ANOVA based on Randomized Group Design(Bademlioglu et al. 2018; Giacomini Sari et al. 2019).

RESULTS AND DISCUSSION

Long leaves of onion plants. The results of the analysis of the length of leaves of shallot plants at the age of 20, 30, 40 and 50 dap showed that the shallot cropping pattern among chilli plants had a significant effect on the length of the shallot plant leaves at the age of 40 and 50 dap; but it has no significant effect at the age of 20 and 30 dap. From Table 1 it can be seen that at the age of 20 and 30 dap the length of shallot leaves is higher in treatment P1 (shallot monoculture). The test results of Tukey test ($\alpha = 0.05$) showed that at the age of 40 dap the longest leaves were obtained in treatment P1 and were significantly different from treatments P3 and P4, but not significantly different from treatments P5, P6 and P7; while at the age of 50 dap. obtained the longest leaves in treatment P5 and significantly different from other treatments, except with treatments P1 and P7 (Table 1). This condition shows that plants grown intercropping are depressed compared to those grown in monocuture. This is due to the existence of competition factors among intercropped plants, especially competition on the intensity of sunlight, water and nutrients. Nurmas (2011) study also found that the height of corn and peanuts were increasingly depressed or lower in the intercropping system compared to those grown in monoculture.

The green leaves of the onion plant. The results of the variance analysis showed that the greenness of the leaves of shallots at the age of 40 dap showed that the shallot cropping pattern among chilli plants did not significantly affect the greenness of the leaves of the shallot varieties of the 'lembah palu', but the highest greenish leaf obtained (99.49 units) in treatment P6 (sigzak cropping pattern) and the lowest (77.29 units) in treatment P1 (shallot monoculture). The greenness of the leaves is very much determined by the leaf chlorophyll content, where leaf chlorophyll is also influenced by the nutrient content, especially the constituent of leaf chlorophyll. Low leaf green content in monoculture shallots can be caused by competition between plants for nutrients, water and sun.

Table 1. The length of leaves of shallot plants aged 20-50 dap in the intercropping system with chili.

Shallot planting between chili plants	Leaf length (cm) of shallots at the age of ...			
	20 dap	30 dap	40 dap	50 dap
P1: Shallot Monoculture	20,01	25,22	30,37 a	31,43 a
P3: Shallot planted strips 1: 1	16,78	20,40	23,67 c	26,09 c
P4: Shallot planted strips 2:1	16,50	20,15	24,53 bc	26,22 c
P5: Shallot planted strips 3:1	19,67	24,30	29,88 ab	32,42 a
P6: Shallot planted by sigzak	17,99	21,70	24,79 abc	26,64 bc
P7: Shallot planted mixed	17,72	22,18	25,81 abc	27,79 abc
Tukey α=0,05	Ns	ns	5,79	5,11

Note : The average number followed by the same letter in the same column is not significantly different from the BNJ test $\alpha = 0.05$.

Table 2. Age of harvesting shallots in the intercropping system with chili.

Shallot planting between chili plants	Age of harvesting (days after planting)
P1: Shallot Monoculture	62.00 b
P3: Shallot planted strips 1: 1	67.00 a
P4: Shallot planted strips 2:1	67.00 a
P5: Shallot planted strips 3:1	67.00 a
P6: Shallot planted by sigzak	67.00 a
P7: Shallot planted mixed	67.67 a
Tukey α=0,05	0.67

Note : The average number followed by the same letter in the same column is not significantly different from the BNJ test α = 0.05 .

Table 3. Fresh Weight of Shallot Bulbs Per Hectare in The Intercropping System With Chili.

Shallot planting between chili plants	Fresh weight of shallot bulbs (t/ha)
P1: Shallot Monoculture	1,83 a
P3: Shallot planted strips 1: 1	0,39 c
P4: Shallot planted strips 2:1	0,74 bc
P5: Shallot planted strips 3:1	1,19 ab
P6: Shallot planted by sigzak	0,61 bc
P7: Shallot planted mixed	0,85 bc
Tukey α=0,05	0,65

Note: The average number followed by the same letter in the same column is not significantly different from the BNJ test α = 0.05.

Harvest age. Harvest age can indicate the length of the period of a plant to complete its life cycle from planting to harvest. Harvest age can be influenced by the interaction of place height (temperature), variety and soil moisture.(Shiina et al. 2011; Wainwright, Jordan, and Day 2014) The results of the variety of harvest age of the shallot varieties 'lembah palu' showed that the pattern of shallot cropping among chilli plants significantly affected the age of shallot crop harvest.

The tukeytest (α = 0.05) results showed that the fastest harvesting age of the shallot of 'lembah palu' (62 days) occurred in treatment P1 (shallot monoculture) and was significantly different from other treatments (Table 2). This can be caused by the single crop pattern (monoculture) with more plant population per plot compared to other cropping patterns, so that the composition of environmental factors, especially temperature, water and light intensity is higher and will subsequently cause higher plant temperatures, so that the shallot plants are more quickly switched to the generative phase and the plants are harvested faster. This result is in line with the results of Ansar's research (2012) that the age of shallot harvest is influenced by the temperature and moisture content of the soil.

Bulb Length. The results of the analysis of shallot tubers of the ’lembah palu’shallot varieties showed that the shallot cropping pattern among chilli plants had no significant effect on tuber length. The average length of the 'lembah palu' shallot tuber is 25.64 mm in treatment P7 (mixed

cropping pattern) followed by treatment P5 (stripping pattern 3:1) which is 25.17 mm, while the shortest tuber size (23,23 mm) obtained in treatment P3 (stripping pattern 1:1). The length of shallot tubers 'lembah palu' ranges from 2.5-3.4 cm (Mentan, 2011).

Fresh Weight of Bulbs Per Clump. The results of the analysis of the variety of fresh weight of tubers per shallot variety of the 'lembah palu' showed that the shallot cropping pattern among chilli plants had no significant effect on the fresh weight of tubers per shallot plant cluster; but the highest average weight of tuber with leaves was obtained (35.89 g/clump) in treatment P6 (sigzak cropping pattern) and the lowest was in treatment P3 (stripping pattern 1:1) which was 23.22 g/clump and almost the same large with treatment P1 (monoculture cropping pattern) which is 23.67 g/clump.

Fresh Weight Per Bulb. The results of the analysis of the fresh weight variety of shallot tubers of the 'lembah palu' varieties showed that the shallot cropping pattern among chilli plants did not significantly influence the fresh weight per bulb of shallot plants. The average fresh weight per tuber was obtained higher in treatment P5 (stripping pattern 3:1) which was equal to 3.13 g/tuber and the lowest (2.07) was treatment P4 (stripping pattern 3:1).

Fresh Weight of Bulbs Per Hectare. The results of the analysis of the variety of fresh weight of tubers per hectare of shallot varieties of 'lembah palu' showed that the pattern of shallot cropping among chilli plants significantly affected the fresh weight of shallot bulbs per hectare.

The tukey test ($\alpha = 0.05$) results showed that treatment P1 (shallot monoculture) yielded the freshest tuber weight with the highest leaves per hectare (1.83 t/ha) and followed by treatment P5 (stripping pattern 3:1) with tuber yield of 1.19 t/ha. The lowest yield of tuber with leaves per hectare was obtained in treatment P3 (stripping pattern 1:1) which was 0.39 t/ha(Table 3). The difference in yield of shallot bulbs due to differences in cropping patterns is strongly influenced by the level of competition that occurs between plants in the planting media. Competition between plants in taking water, nutrients and utilizing sunlight is a major problem in intercropping systems. The most decisive factor is how long the competition process takes place and at what stage of growth the competition takes place. If the competition of plants on environmental factors lasts quite a long time, it will give a real influence on the growth and yield of plants. Likewise if the competition occurs in the phase of active vegetative growth, fertilization, and fruit filling/enlargement, it will have a negative impact on crop yields.

Harvest Index. The harvest index is the result of sharing between economic crops with biological results, which can illustrate the efficiency of assimilate distribution to economic results and the ability to accommodate photosynthesis (Ansar, 2012). The results of the variety of shallot harvest index showed that the shallot cropping pattern among chilli plants had no significant effect on the harvest index of the varieties of shallot tuber 'lembah palu' variety.

Moisture content of bulbs. The results of statistical analysis of the varieties of shallot tubers 'lembah palu' showed that the pattern of shallot cropping among chilli plants did not significantly affect the moisture content of the shallot plant bulbs. The average tuber water content was lowest (69.35%) from treatment P4 (stripping pattern 2:1) and lower than other treatments. Water content of tubers is strongly influenced by temperature and soil moisture content.

CONCLUSION

The results showed that (i) various shallot cropping patterns among chilli plants did not significantly affect the greenness of leaves, tuber length, fresh weight per tuber, fresh weight of tubers per batch, harvest index and moisture content of shallot bulbs; (ii) leaf length, harvest age

and fresh tuber weight of shallot bulbs per hectare planted with different cropping patterns among chilli plants were not significantly different, except with monoculture shallot cropping patterns obtained by longer leaves, shorter harvest age (62.0 days) and the weight of fresh bulbs per hectare is higher (1.83 t/ha), compared to various shallot cropping patterns among chilli plants.

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