# THE EFFECT OF ROW PROPORTION OF MAIZE AND SOYBEAN INTERCROPPING ON GROWTH AND YIELD OF COMPONENT CROPS IN SANDY SOIL NORTH LOMBOK, INDONESIA

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## INTRODUCTION

To obtain the best results from maize intercrops with soybeans, it is necessary to adjust the proportion of planting density so that the use of resources is more efficient and does not interfere with the intercropped soybean plants. Adjustments of plant density proportion are to provide better growth space for plant growth and development. Intercropping production is a function of the management of aquaculture and the environment which involves the interaction between soil and microclimate around the plant. Good management of these two factors will result in high crop production [1]. However, the proportion of density that is appropriate for intercropping maize with soybeans in the sandy soil of North Lombok has not been revealed. This study aims to examine the effect of the proportion of density of maize and soybeans planted with intercropping systems on growth components and crop yields in the sandy soil of North Lombok.

## MATERIALS AND METHOD

The experiment was conducted in Akar-Akar village at Bayan district of North Lombok from April to July 2019. The land is located at a geographic position of -8.221650, 116.350283. Randomized Block Design was used in this experiment with five treatments i.e. P1 (2 rows of maize : 2 rows of soybean), P2 (3 rows of maize : 2 rows of soybean), P3 (3 rows of maize : 3 rows of soybean), P4 (4 rows of maize : 2 rows of soybean), P5 (4 rows of maize : 3 rows of soybean). Each treatment was replicated three times. Observations were made on research variables which included: vegetative growth (dry weight of maize roots and soybean) at 40 and 92 days after seeding (DAS), and yields (dry cob and pods yield and weight of 1000 grains of maize and soybean). Plant samples per plot of 5 plants were randomly selected. Data were analyzed using analysis of two way ANOVA and Tukey's HSD (Honestly Significant Difference) means-tested at a 5% level of significance.

## RESULT AND DISCUSSIONS

### Mean Dry Biomass Weight

**Tabel 1.** Mean dry biomass weight (g/plant) of maize and soybean for each treatment of intercropping pattern

| Intercropping pattern | Dry biomass weights (g/plant) of maize and soybean | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Maize root | | Maize shoot | | Soybean root | | Soybean shoot | |
| | 40 DAS | 92 DAS | 40 DAS | 92 DAS | 40 DAS | 92 DAS | 40 DAS | 92 DAS |
| P1 (2m:2s) | 15.28bc | 46.67bc | 36.19bc | 117.41c | 0.40b | 0.59b | 2.11bc | 6.59bc |
| P2 (3m:2s) | 11.05cd | 41.82bc | 47.46bc | 136.71c | 0.27b | 0.94ab | 2.41bc | 4.59c |
| P3 (3m:3s) | 23.27ac | 56.26ac | 85.25ac | 381.19ac | 0.83ac | 1.81ac | 3.81ac | 12.26ac |
| P4 (4m:2s) | 17.52bc | 26.06c | 47.58bc | 250.07bc | 0.42bc | 1.16abc | 2.55bc | 7.20bc |
| P5 (4m:3s) | 8.45d | 12.50d | 48.43bc | 68.97d | 0.37bc | 0.75abc | 1.53cd | 8.81abc |
| HSD 5% | 3.21 | 5.29 | 7.87 | 14.47 | 0.16 | 0.69 | 0.38 | 2.49 |

Mean values in each column followed by the same letters are not significantly different between treatments of intercropping pattern

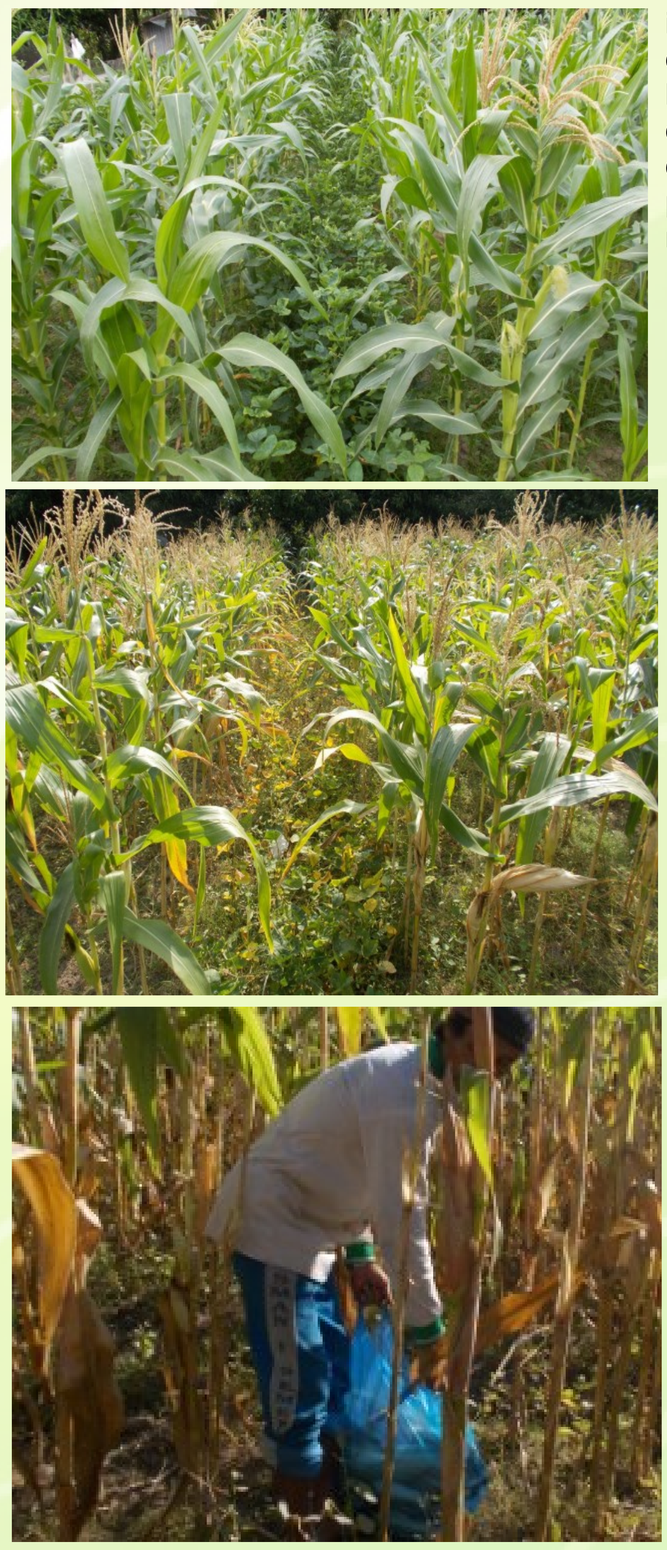
### Mean Dry Yield Weight

**Table 2.** Mean weight of dry cob and pods yield (g/plant) and 1000 dry grains for each crop and each treatment of intercropping pattern

| Intercropping pattern | Mean dry cob and pods yield (g/plant) and weight of 1000 dry grains (g) | | | |
|---|---|---|---|---|
| | Maize | | Soybean | |
| | Cob yield | 1000 grains | Pods yield | 1000 grains |
| P1 (2m:2s) | 93.11ab | 231.67c | 4.07b | 148.33b |
| P2 (3m:2s) | 83.79ab | 230.00c | 2.87b | 146.66b |
| P3 (3m:3s) | 128.03a | 303.33a | 9.39a | 183.33a |
| P4 (4m:2s) | 108.04a | 236.67c | 3.55b | 160.00ab |
| P5 (4m:3s) | 35.23c | 261.67b | 3.93b | 168.33ab |
| HSD 5% | 30.15 | 13.45 | 1.04 | 18.01 |

Mean values in each column followed by the same letters are not significantly different between treatments of intercropping pattern

### Figure Growth and Yield



Plant density affects the weight of dry root biomass and shoot of maize and soybean planted with intercropping systems (Table 1). The highest biomass weight and significantly different from other treatments can be seen in the plant density of 3 rows of maize: 3 rows of soybean P3) both at the age of 40 and 92 das. The addition of one row of maize plant density which was originally 3 rows to 4 rows causes a decrease in the weight of dry root biomass and shoot of maize and soybean plants. The root weight and dried shoots of maize fell to 3.5 and 4.5 times and the weight of dried roots of soybeans fell to 1.41 times at the age of 92 days after observing the 4:3 ratio of maize and soybean plants (P5). This indicates the status of soil N nutrients in maize and soybean improved at a ratio of the density of maize and soybean 3: 3. There was a direct transfer of N from maize-soybean plants which were easily released by soybean plants. This causes the growth of maize stimulated by the intercropping of soybean plants. It is known that soybean plants can release large amounts of N with the help of the Rhizobium bacteria called rizodeposit which includes root exudates, rootlets, and decomposition of organic matter during the harvest cycle. Improvement of soil N nutrients due to the N-binding bacteria that can fix N directly from the air in the affected soybean plants also in maize plants, causing the growth of roots and shoot plants to be good [2].

The appropriate plant density for maize and soybean plants is 3 rows of maize and 3 rows of soybeans (P3) with cob weights 128.03 g/plant and pod weights 9.39 g/plant Table 2). At the planting density, the maize population is 14,700 plants/ha (35% of the monoculture population) and 26,315 soybean plants/ha (15% of the monoculture population). If the number of maize rows is increased to 4 rows and soybean rows remain 3 rows (P5), the yield of soybean pods and pods will decrease significantly up to 3.5 times and 2.3 times, while for 1000 grain weights down to 1.15 times and 1.08 times. This indicates that the density of 3 rows of maize and 3 rows of soybeans has a higher tolerance in nutrient availability and nutrient absorption of N and P which causes the higher weight of cob, pods, and seeds. This difference in yield is very likely due to differences in plant density, plant layout, and spacing. This difference causes differences in growth and yield due to differences in the growth of different individual plants [3]. Increasing the density of maize plants from 3 rows to 4 rows can reduce the growth of maize and inhibit the growth of soybeans planted with intercropping systems [4, 5], especially on plant density of 4 rows of maize with 3 rows of soybeans, which can be seen in the decrease in the weight of maize cobs and soybean pods. From this study, it was found that the level of aggressiveness of maize was evident when intercropped with soybean at a density of 4: 3. The density ratio of 4: 3 caused the growth of maize and soybean plants to be depressed due to plant density which caused less stimulation of photosynthesis in plant leaves.

## CONCLUSIONS

The results show that crops intercropping density of 3 rows of maize:3 rows of soybean maintains a high growth and yield. Increase of one more row from 3 to 4 rows, significantly decreases the weight of maize cobs (3.5-folds), pods (2.3-folds), and 1000 seeds (1-folds). The addition of one row of maize plant density which was originally 3 rows to 4 rows causes a decrease in the weight of dry root biomass and shoot of maize and soybean plants. The root weight and dried shoots of maize fell to 3.5 and 4.5 times and the weight of dried roots of soybeans fell to 1.41 times at the age of 92 days after observing the 4:3 ratio of maize and soybean plants.

## REFFERENCES

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