# Effect of Plant Spacing on Yield of Several Indigenous Vegetables

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## ABSTRACT

**The objective of this research was to determine effect of different spacing on growth and yield of several indigenous vegetables (katuk, kenikir, and kemangi). The research was conducted at SANREM Experimental Station in Nanggung, Bogor from December 2007 until July 2008. The experimental design was a randomized block design with four levels of population (50,000 plants/ha, 100,000 plants/ha, 150,000 plants/ha, and 200,000 plants/ha) and three replications. The variables observed were plant height, number of leaves, branches, shoots, shoot length, yield/plant, and yield/plot. The results of this experiment showed that the highest fresh yield on katuk achieved at population of 150,000 plants/ha. Optimum population on katuk was 160,000 plants/ha. The highest yield in kenikir was obtained at population of 100,000 plants/ha. Optimum population of kenikir was 126,667 plant/ha. However, up to 200,000 plants/ha, yield response of kemangi was still linear.**

## INTRODUCTION

Various indigeneous vegetables grow in Indonesia and has been used by community. Kenikir (*Cosmos caudatus* Kunth), kemangi (*Ocimum americanum* L) and katuk (*Sauropus androgynus* L. Merrill) are among popular vegetables in Java. Leaves of kenikir and kemangi are consumed raw, while katuk is cooked as traditional soup.

Currently vegetable consumption in Indonesia is on average 39 kg/capita/year while standard for FAO is 65.75 kg/capita/year. (Puslitbang Gizi dan Makanan, 2007; www.p3gizi.litbang.go.id). Most of vegetables consumed is temperate vegetables which are usually planted in limited area of highland. Therefore, indigenous vegetables may contribute to the increase of vegetable consumption.

Indigenous vegetables are usually planted in home garden as minor crops. Production of indigenous vegetables can be increased by good cultural techniques. Among the techniques is plant spacing. The spacing regulates placement of plant and population in an area (Zaubin, 2005). This will ensure optimal space for light, water, and nutrient, reduce competition among the same crops, and ease the maintenance. Teeropolvichitra (1983) reported that closer spacing increased productivity of tomato, while Bilman (1998) reported that closer spacing increased leaf area of sweet corn.

The objective of the research was to determine effect of different spacing (population) on yield of kenikir, kemangi, and katuk.

## MATERIALS AND METHOD

The experiments were conducted at SANREM Experimental Station in Nanggung, Bogor from December 2007-June 2008. Seeds of kenikir (Pandeglang accession), kemangi (Cadasari accession) and katuk (Ciampea accession) were used. The experimental design was Completely Randomized Block Design of one factor. The treatments were 50,000 plants/ha (P1), 100,000 plants /ha (P2), 150,000 plants /ha (P3) and 200,000 plants /ha (P4). The experiment was replicated three times. Seeds were germinated in compost-soil media (1:1). Seedlings were transplanted in beds of 4 m x 1 m. The following spacing was applied to obtain the desired population: 50 cm x 40 cm (P1), 50 cm x 20 cm (P2), 50 cm x 13.3 cm (P3), 50 cm x 10 cm (P4).

At planting time, mix of chicken manure plus rice husk (5 ton/ha) and $P_2O_5$ (135 kg/ha) were applied Nitrogen (Urea) and $K_2O$ at 100 kg/ha and 135 kg/ha respectively were applied twice (2 and 5 WAP). Dead and weak plants were replaced. Weeding, pest and disease control were done mechanically. Harvest was done based on criteria. Data were analyzed by SAS Regression analysis was done on yield data.

## RESULTS AND DISCUSSION

Kenikir and kemangi grew well and uniformly, while katuk were uniform in replication (rep) 2 and 3, but in rep 1 was less uniform due to poor drainage. Anova of observed variables of katuk is presented in Table 1. It shows that yield per plot was significant while for other variables were not significant.

Table 1. Anova of Katuk

| Week after planting | Leaf number per plant | Branch number/plant | Yield per plant | Yield per plot |
|---|---|---|---|---|
| 4 | ns | ns | - | - |
| 5 | ns | ns | - | - |
| 6 | ns | ns | - | - |
| 7 | ns | ns | ns | * |

ns = not significant; * significant at 5%

Population did not show significant effect on yield per plant, although the value showed some decrease (Table 2). However, yield per plot showed significant increase from 99 g/plot at 50,000 plants/ha to 229.9 g/plot at 150,000 plants/ha. Based on regression equation (Figure 1) of $y = -1 E^{-8} x^2 + 0.0032x - 39.417$ ($R^2 = 46.7$ %), optimum population of katuk was 160,000 plants/ha

Table 2. Weight per plant and yield per plot of katuk

| Population (plants/ha) | Yield per plant (g) | Yield per plot (g) |
|---|---|---|
| 50,000 | 46.7 | 99.0 |
| 100,000 | 55.0 | 175.7 |
| 150,000 | 35.5 | 229.3 |

| | | |
|---|---|---|
| 200,000 | 27.2 | 208.3 |

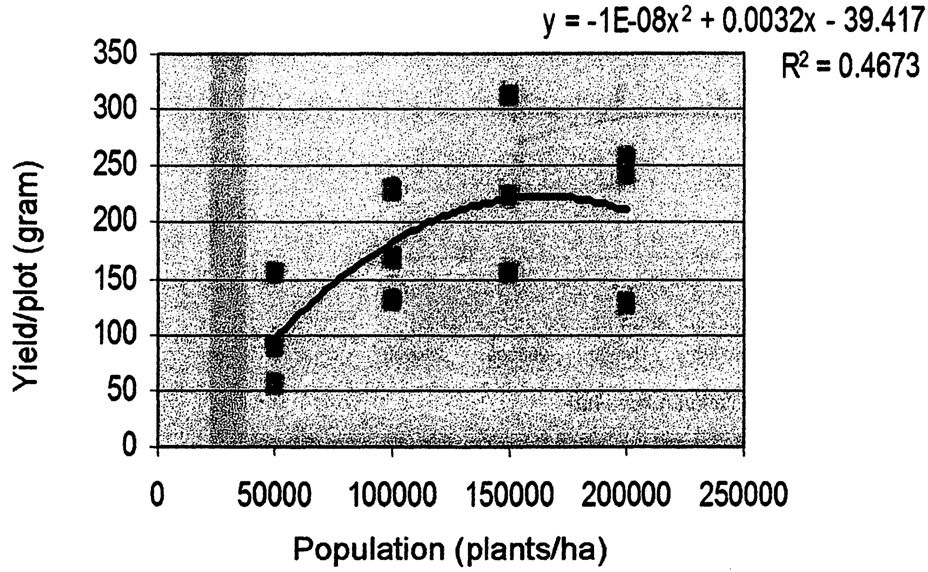


Figure 1. Yield per plot of katuk in several plant density

Table 3. Anova of Kenikir

| Week after planting | Plant Height | Leaf number/plant | Branch number/plant | Yield per plant | Yield per plot |
|---|---|---|---|---|---|
| 2 | ns | ns | - | - | - |
| 3 | ns | ns | - | - | - |
| 4 | ns | ns | ns | - | - |
| 5 | ns | ns | ns | - | - |
| 6 | ns | ns | ns | - | - |
| 7 | ns | ns | - | ns | + |

ns = not significant

Anova of kenikir is presented in Table 3. Table 3 showed that population did not show significant effect on plant height, leaf number, branch number, and yield per plant but tended to give significant effect on yield per plot. Yield per plant showed some degree of reduction from 92.9 g to 34.2 g/plant. Yield per plot increased up to 1528.7 g/plot at 100,000 plants/ha or equivalent of 3.82 ton/ha. Higher population gave lower yield than P2 (100,000 plants/ha). Mortley et al. (1991) reported that population 161,000 plants/ha increased yield per unit area. At lower population, use of nutrient might not be optimal and competition with weed was higher. Regression analysis gave an equation $Y = -3E^{-08} x^2 + 0.0076 x + 1031.1$ and predicted optimum population is 126.667 plants/ha (Figure 2).

Table 4. Yield per plant of kenikir

| Population | Yield per plant (g) | Yield per plant (g) |
|---|---|---|
| 50,000 | 92.9 | 1316.0 |
| 100,000 | 52.2 | 1528.7 |
| 150,000 | 46.0 | 1417.70 |
| 200,000 | 34.2 | 1318.30 |

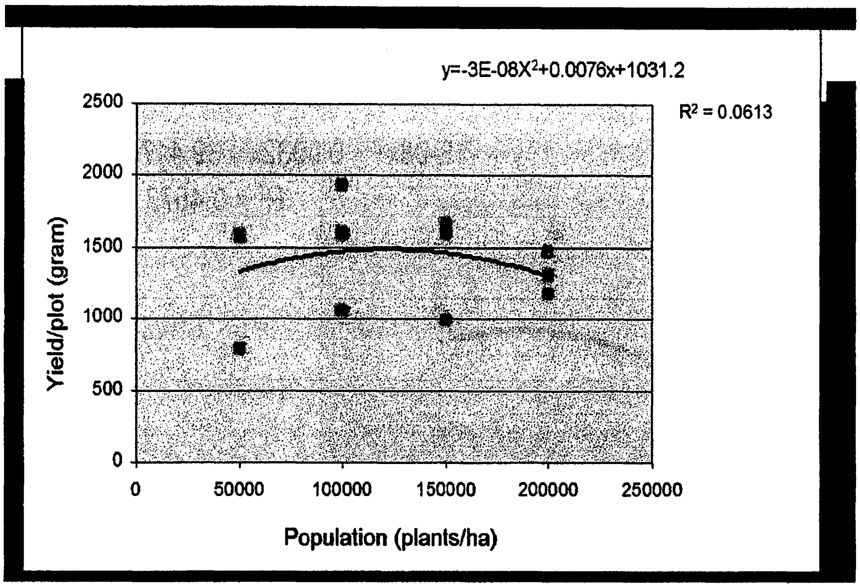


Figure 2. Yield per plot of kenikir as influenced by population

Table 5 showed that population did not give significant effects on plant height at 2, 3, and 4 weeks after planting (WAP), number of leaf/plant (2, 3, and 4 WAP), number of branch/plant (2, and 4 WAP), and yield per plot. Population gave significant effect on plant height (5 WAP), number of leaf/plant (5WAP) and yield per plant (5WAP) and number of branch/plant (5 WAP, 10%).

Table 5. Anova of Kemangi

| Week after planting | Plant Height | Number of leaf/plant | Number of branch/plant | Yield per plant | Yield per plot |
|---|---|---|---|---|---|
| 2 | ns | ns | - | - | - |
| 3 | ns | ns | ns | - | - |
| 4 | ns | ns | ns | - | - |
| 5 | ** | * | + | * | ns |

ns = not significant

Table 6. Yield per plant and yield per plot of kemangi

| Population (plants/ha) | Yield per plant (g) | Yield per plot (g) |
|---|---|---|
| 50,000 | 35.4 | 606.7 |
| 100,000 | 40.1 | 823.7 |
| 150,000 | 20.6 | 1053.3 |
| 200,000 | 27.1 | 1053.3 |

Population 100,000/ha gave yield per plant of kemangi 40.1 g/plant (Table 6). Higher population caused lower yield per plant. Yield per plot increased as the population increased (Table 6, Figure 3). Population of 150,000 gave same yield as population of 200,000. Based on regression analysis, population of kemangi up to 200,000 plants/ha showed linear response. Preece and Read (2005) stated that high population may cause lower quality, as leaves overlapped, branches lengthen, and higher competition to obtain water and nutrient. Population increased yield up to optimum population, and at higher population will not increase yield or stagnant.

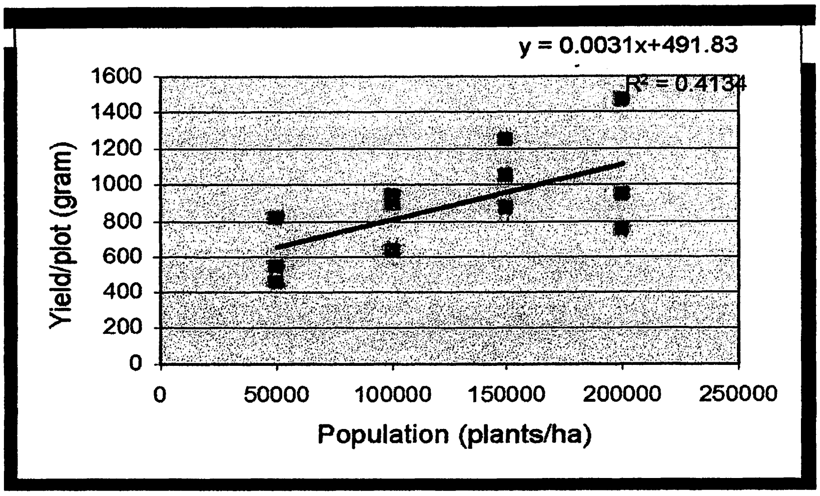


Figure 3. Yield per plot of kemangi as influenced by population

## CONCLUSION

Optimum population of katuk is 160,000 plants/ha, while for kenikir the optimum population is 126,667 plants/ha, and kemangi might be more than 200,000 plants/ha. Up to 200,000 plants/ha, yield response of kemangi is linear.

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