



Tropentag, September 11-13, 2024, hybrid conference

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## Productivity of soybean-maize-mung bean intercropping in East Java, Indonesia

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### Abstract

Indonesia relies on imported soybeans for over 90% of its consumption. Intercropping with maize has been proposed as a pathway towards increased soybean production. Intercropping of maize and soybean has been reported to improve land use efficiency, but the yield of soybean is negatively impacted by shading from maize. There is little information on what might be optimal plant configurations in different seasons in Indonesia. Hence, we evaluate the productivity of maize-soybean intercropping in Indonesia, while testing different configuration options to mitigate possible shading effects on soybean.

Experiments were done across the rainy and dry seasons in 2022 and 2023 at a site near Probolingo, East Java. We compared four configurations:

1. a 2M:4S replacement intercrop comprising 2 rows of maize alternating with 4 rows of soybean (replacement intercrop); in this system, we compared two soybean cultivars;
2. a 2M:4S replacement intercrop with maize planted at a narrow row distance to increase the space for soybean (replacement intercrop);
3. the same 2M:4S maize-soybean configuration as configuration 2, with two mung bean rows planted in the space between soybean and maize (additive intercrop)
4. as configuration 2, but with two additional soybean rows, so a 2M:6S additive intercrop.

Grain and biomass yields of each crop species in each treatment were recorded, and the relative land productivity of intercropping was assessed using the land equivalent ratio (LER).

The results showed that the LER ranged between 0.89 and 1.16. Widening the space for soybeans in configuration 2 increased soybean yield without impacting maize yield. Additive intercrops (configurations 3 and 4) had greater LER than replacement intercrops.

Estimates of LER were moderate, diverging from studies reporting high LER (1.61–1.63) in Indonesia, but aligned with research in temperate climates showing limited yield advantage with simultaneous intercropping. The narrow maize row system increased soybean yield but did not adversely affect maize yield.

**Keywords:** Indonesia, intercropping, maize, soybean