

**Thesis title**            **Nitrogen Fertilizer Management  
in Vegetable Soybeans**

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**ABSTRACT**

This study commenced with a survey of the farm condition under which vegetable soybeans are produced in Chiang Mai. From the survey, it was found that, unlike in soybeans that are grown for grain, farmers used a lot of nitrogen fertilizer on vegetable soybean, up to 100 kg N/ha. Many field experiments have shown that nitrogen fertilizer is essential for maximum marketable yield of vegetable soybean, but high rate of nitrogen fertilizer can also depress nitrogen fixation. A field experiment was conducted to evaluate effects of nitrogen fertilizer management on yield and the amount of nitrogen fixed in vegetable soybeans. There were 12 treatments which were a factorial combination of six nitrogen fertilizer managements on two vegetable soybean varieties, 301 and AGS292. The experiment was carried out on San Sai soil, low in total nitrogen (0.061%), pH of 6.3 at the multiple

Cropping Center Research Station of Chiang Mai University, Thailand. Estimates of vegetable soybean nitrogen fixation in vegetable soybean were made by the xylem sap analysis method.

Marketable and total fresh pod yields were increased by nitrogen fertilizer application in both varieties. Minimum starter N at 25 kg /ha gave the minimum marketable and total pod yield in both varieties. Adding top dressing at the flowering stage gave slight improvement in marketable but no improvement in total pod yield while adding top dressing at an earlier stage V1.5 increased the marketable pod yield and total yield by 44% and 14.4% in 301 and 43% and 20% in AGS292 respectively. Adding the second top dressing at the V4 stage, after the first dressing at the V1.5 stage (Farmer's practice), depressed the marketable and total pod yield. However, the second dressing applied at the R1 stage or R4.5 stage, led to further an increase in the marketable pod yield and total pod yield in both varieties.

The N fertilizer also increased dry matter and crop nitrogen uptake in both varieties. However, adding 50 kg N/ha top dressing at V1.5 stage and 25 kg N/ha as the second dressing at the reproductive stage (either at the R1 or R4.5 stage) was the most effective in the dry matter accumulation and nitrogen uptake, compared with the other nitrogen treatments.

Before the V4 stage, nodulation was enhanced with higher level nitrogen application and was inhibited by nitrogen fertilizer applications in both varieties afterwards and most severely at the R1 stage. This was reflected the depression of the relative abundance of ureide nitrogen in xylem sap. This depression effect, however, disappeared after R5 stage.

The effect of N on capacity to fix nitrogen in the two different genotypes is different. The treatment with the starter nitrogen at 25 kg N/ha, vegetable soybean in AGS292 fixed 125 N kg/ha while vegetable soybean in 301 just fixed 113 N kg/ha. In general, adding 50 kg N/ha top dressing at the flowering stage had no effects on the total amount of nitrogen fixed. However, adding 50 kg N/ha top dressing at the V1.5 stage gave no improvement on the total nitrogen fixed in 301 but gave significant improvement in AGS292. Adding 50 kg N/ha top dressing at the V1.5 stage and 25 kg N/ha as the second dressing at the V4 stage led to depress significantly in the total amount nitrogen fixed in both varieties. However, the application of the second dressing applied at the R1 stage had no further effect on N fixation in both varieties. Furthermore, the second dressing was applied at the R4.5 stage, had a further increase in the nitrogen fixation in 301 but no increase in AGS292.

After both green pod and straw were removed, which was the common practice by farmers, it was estimated that the removal of nitrogen exceeded the input of nitrogen from fixation, ranging from -22 kg N/ha to -65 kg N/ha. However, if the straw was returned to the soil, nitrogen balance was well improved. There was a positive nitrogen balance starting from 22 kg N/ha up to 55 kg N/ha.

After the preplanting application of 25 kg N/ha starter nitrogen, the net income from vegetable soybean was effectively increased by fertilizer management, but time of nitrogen application was important. Farmers' top dressing (25 and 50 kg N/ha at V1.5 and V4) added an expense of 2473 baht/ha with little effect on net income. The same amount of nitrogen, at the same cost, with the second top dressing delayed to R1 or R4.5 increased the net income by 15,000 to more than 20,000 baht/ha.