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Convenient Seed Production Pattern in Different Populations of *Momordica charantia* Linn.

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Abstract
The convenient seed production pattern in different populations of *Momordica charantia* Linn. was investigated. The experiment was conducted at Maehea Field Research and Agricultural Training Station, Faculty of Agriculture, Chiang Mai University. Two production patterns were investigated by using triangular-support and without support. The best production pattern found to be without support, which provided best seed quality and better seed germination. The optimum population for seed production was 10000 plants per hectare, which gave the highest number of fruit per plant (20.7) and the best weight 100 seeds (6.15 gram). The seed yield of the used three planting methods was not significantly different.

Introduction
Momordica charantia Linn. is a monoecious plant under the family Cucurbitaceae, which commonly called krela, bitter gourd, bitter melon balsam pear etc. Kenya exports bitter guard to Europe, and London. The price is US$ 8 per kg in Germany and in Netherlands and 25 bath per kg in Thailand. The planting material is seed that is easily way for planting. However most of the researchers were interested for fresh fruit production than seed. Such as Huyskens et al. in 1992 found the optimum population for fresh fruit production was 10000 plant/ha, but they didn't know about the optimization of good quality seed production. The high yield of fresh fruit does not mean quality and high quantity, seed production. Therefor, this experiment was finding the optimized production pattern in various populations for seed quality production.

Materials and Methods
The trial was conducted at Mae-hea Field Research and Agricultural Training Station, Faculty of Agriculture, Chiang Mai University. The experimental design was Factorial in RCB, with four blocks and two factors. The first factor was two production patterns, which was investigated by using triangular-support and non-support (Figure 1). The second factor was three populations, viz. 10000, 20000 and 40000 plant/ha. The harvested seed yield of yellow fruit was considered yield of crop (Figure 2g-i). The experiment continued from August to December 1998.

Results

Production patterns did not influence on seed yield is including on other components. The plant population effected on number fruit/plant and weight of 100 seeds, but not on seed yield. The plant population at 10000 plant/ha, produced higher number of fruit per plant compared to than 20000 and 40000 plant/ha. Regarding the weight of 100 seeds, the plant population at 10000 plant/ha gave the highest by 6.15 g. The seed weight of 20000 plant/ha was 5.85 which was obviously less than 10000 plant/ha but not significantly different (Table 2). However, the seed weight of 100 g. for 10000 plant/ha was significantly highest than 40000 plant/ha. The plant population at 40000 plant/ha gave less number of fruit per plant than 20000 plant/ha. The seed from non-support pattern had higher germination than triangular-support pattern by 10.9 percent, but no influence was appeared on the population of bitter guard. Production pattern and plant populations did not effect on seedling growth rate (SGR). No interaction was found between production pattern and plant populations.

Figure 1 The bitter gourd planting by used triangular support (Left) and didn't use triangular supports (Right).

Figure. 2 Developmental of biter gourd fruit form after fertilization until ripening, a-e) Young green fruit, f) Haft fruit ripening, g) Fruit ripening all and h-i) Fruit ripening and breaking

Table 1 Effect of various production patterns and various populations on seed yield (kg/ha) and number of fruits (fruit/Plant).

		Seed Yield (kg/ha)			Number of Fruit (fruit/plant)		
		Pattern			Pattern		
		support	Non-support	Mean	support	Non-support	Mean
Population	10000 plant/ha						
	20000 plant/ha						
	40000 plant/ha						
	Mean						
LSD (5%)	Pattern (A)					NA	
	Population (B)					1.59	
	Interaction (A×B)					NA	
	SE						
	CV%						

NA= not applicable

Table 2 Effect of various production patterns and various populations on number of seeds per fruit (seed/fruit) and weight (g) of 100 seeds**.**

		Number of Seed (seed/fruit)			weight of 100 seeds (g)		
		Pattern			Pattern		
		support	Non-support	Mean	support	Non-support	Mean
Population	10000 plant/ha						
	20000 plant/ha	.0					
	40000 plant/ha						
	Mean						
LSD (5%)	Pattern (A)						
	Population (B)						
	Interaction (A×B)						
	SE						
	CV%					.90	

NA= not applicable

Table 3 Effect of various production patterns and various populations on seed germination percentage and seed growth rate, SGR (mg/seedling).

		Germination (%)			SGR (mg/seedling)		
		Pattern			Pattern		
		support	Non-support	Mean	support	Non-support	Mean
Population	10000 plant/ha						
	20000 plant/ha						
	40000 plant/ha						
	Mean						
LSD (5%)	Pattern (A)						
	Population (B)						
	Interaction (A×B)						
	SE						
	CV%						

NA= not applicable

Conclusion and Discussion

From the result it was revealed that the number of fruit depends on plant population. When the plant population was higher, the less number of fruit was produced. On the other hand, incase of lower plant population, higher number of fruit was produced. High plant population showed more competition and less population at 5000 or 2500 plant/ha may decrease competition between row and plant in row, but produced same seed yield. On the other hand, triangular-support pattern may decrease the competition, but at plant population 10000, 20000 and 40000 plant/ha can not decrease this effect and triangular-support pattern was less germination percentage than non-support pattern. However, many factors are influence on seed quality. Such as, Shrivastava (1972) found maximizing germination in first to third harvesting compared to fifth harvesting, but this experiment ware six harvesting. And dormancy were problem of bitter guard seed, we could seen in this experiment was 62.7 percent and Pinmanee *et. al.* (1999) was 40 percent of seed germination. Therefor, from this experiment we can conclude that the optimum population was 10000 plant/ha and did not use the support, because it decreased the cost of seed and support. In fact, bitter guard can harvest more than six times, because it was indeterminate character although needs good management. But we don't known about number of harvesting times to give maximum seed yield and good seed quality.

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