
Comparison between organic, GAP and chemical methods for cultivation of rice varieties in Cambodia

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Results showed that treatment of organic and chemicals are not significantly different in plant height at 45 days after planting but significantly differed from GAP method and non-treated control. As a result, plant height in organic and chemical methods in rice var Neang Kong were 59.59 and 61.84 cm., respectively followed GAP method (40.69 cm) and non-treated control (39.5 cm). The chemical method in rice var Kea gave significantly highest in plant height (64.51 cm) and followed by GAP and organic methods (53.55 and 43.89 cm) when compared to the non-treated control (37.26 cm). Moreover, the organic, GAP and chemical methods are not significantly different in tiller number at 90 days after planting but significantly differed from non-treated control. As a result, the organic, GAP and chemical methods in rice var Neang Kong at 90 days were 18.00, 17.33 and 14.33 tillers per plot., respectively but non-treated control was 4.33 tillers. The organic, GAP and chemical methods in rice var Kea at 90 days were also not significantly different in tiller number which were 15.66, 15.33 and 14.66 tillers, respectively but significantly differed to the non-treated control (7.00 tillers). The experiment is being investigated until harvest. In Neang Kong variety, the tillers, panicles and fresh weight of seeds or yield were increased after using organic methods of 75.94, 63.46, 76.76 %, respectively. GAP method could increase the tillers, panicles and yield of 75.01, 68.18 and 73.70 %, respectively. Chemical method could also increase in the tillers, panicles and yield of 68.78, 71.50 and 73.36 %, respectively when compared to the non-treated control. In Kea variety, the tillers, panicles and fresh weight of seeds or yield were increased after using organic methods of 55.33, 48.64, 60.02 %, respectively. GAP method could increase the tillers, panicles and yield of 52.25, 50.64 and 49.15 %, respectively. Chemical method could also increase in the tillers, panicles and yield of 55.33, 55.81 and 52.48 %, respectively when compared to the non-treated control.

Keywords: GAP, organics, CM product, *Oryza sativa*

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Introduction

Rice belongs to the family of Gramineae and the genus *Oryza*. *Oryzae* contains about 20 different species of which only two are cultivated: *Oryza sativa* L. (Asian rice) and *Oryza glaberrima* Steud. (Africa rice). (Matsuo *et al.*, 1995). Rice is central to the lives of billions of people around the world. Possibly the oldest domesticated grain (10,000 years), rice is the staple food for 2.5 billion people (IRRI, 2002), and growing rice is the largest single use of land for producing food, covering 9 % of the earth's arable land. Rice provides 21% of global human per capita energy and 15% of per capital protein (IRRI, 2002). Calories from rice are particularly important in Asia, especially among the poor, where it accounts for 50-80% of daily caloric intake (IRRI. 2001). As expected, Asia accounts for over 90% of the world's production of rice, with China, India and Indonesia producing the most . (International Year of Rice, 2004). Only 6-7% of the world's rice crop is traded in the world market. Thailand, Vietnam, China and the United States are the world's largest exporters. The United States produces 1.5% of the world's rice crop with Arkansas, California and Louisiana producing 80% of the U.S. rice crop (IRRI. 2002). 85% of the rice that is produced in the world is used for direct human consumption (IRRI. 2002). Rice can also be found in cereals, snack foods, brewed beverages, flour, oil, syrup and religious ceremonies to name a few other uses.

Rice is grown under many different conditions and production systems, but submerged in water is the most common method used worldwide. Rice is the only cereal crop that can grow for long periods of time in standing water(International Year of Rice, 2004). The 57% of rice is grown on irrigated land, 25% on rainfed lowland, 10% on the uplands, 6% in deepwater, and 2% in tidal wetlands (Chopra and Prakash, 2002). The flooded rice paddy is a field of aquatic biodiversity, providing a home for fish, plants, amphibians, reptiles, mollusks, and crustaceans, which many of can be used as a means to incorporate protein into the diets of poor and malnourished people in low and middle income countries that farm rice (International Year of Rice, 2004). Just as rice can be grown in many different environments, it has many characteristics, making one variety more popular in one region of the world than another. Rice can be a short, medium or long grain size. It can also be waxy (sticky) or non-waxy. Some rice varieties are considered aromatic. (Alford and Duguid, 1998 and Chaudhary, *et al.*, 2001). Rice also comes in many different colors including brown, red, purple and black (International Year of Rice, 2004). The main problem associated in rice production is high agricultural inputs including chemical fertilizer and pesticide leading to high production cost but gain low yield. These problems face from low soil fertility,

insect and pathogen become resistant to chemical pesticides. The research finding is to compare the application methods between Chemicals, GAP (good agricultural practices) and Organic methods of rice varieties from Cambodia.

Materials and methods

The experiment was conducted by using two factorial experiment in Randomized Completely Block Design (RCBD) with 3 replications. Factor A represented two varieties of rice and factor B represented different application methods. There are 8 treatment combinations are as follows:- Factor A was varieties of rice from Cambodia, A1 = Neang Kong Variety and A2 = Kea Variety. Factor B was different application methods, B1 = non treated control, B2= Organic (applying Organic biofertilizer 20 g/pot, liquid organic biofertilizer 40 cc/20L, Bio-insecticide (*Metarhizium* and *Beauveria*) 40 cc/20L and CM product (*Chaetomium* bio-fungicide and Mycephyt-plant growth stimulant) 10 g/20 L, B3= good agricultural practice, GAP (chemical-organic biofertilizers 9-3-4 and 8-3-8 at 20 g/pot, alternative spraying with bio-insecticide , CM product and chemical insecticides, Abamectin 20 cc/20L and chemical fungicide, Benomyl 5 g/20L) and B4 = Chemicals (urea 46-0-0, 15-15-15 at 10 g/pot, and spraying with chemical insecticide, Abamectin 20 cc/20L and chemical fungicide, Benomyl 5 g/20L. Data were collected as plant height (cm), number of the tillers, fresh weight of stem (g), number of Panicle and fresh weight of panicle (g).

Results and discussions

In Neang Kong variety, it showed that the organic method gave significantly highest in plant height at 15, 30 and 45 days (24.56, 32.26 and 59.59 cm, respectively) and followed by GAP which the plant height at 15, 30 and 45 days were 22.95, 31.16 and 40.69 cm, respectively when compared to the non-treated control which the plant height at 15, 30 and 45 days were 22.76, 26.84 and 39.50 cm, respectively (Table 1., Fig. 1). As a result, Sibounnavong *et al* (2006) also stated the organic method would promote the plant height if applying an appropriated agricultural inputs.

In Kea variety, it showed that the organic method gave significantly highest in plant height at 15, 30 and 45 days (21.14, 26.36 and 37.26 cm, respectively) and followed by GAP which the plant height at 15, 30 and 45 days were 22.74, 29.40 and 43.89 cm, respectively when compared to the non-treated control which the plant height at 15, 30 and 45 days were 21.14, 26.36 and 37.26 cm, respectively. As Chalee (2005) reported that organic crop production would success if application of appropriate agricultural inputs.

Table 1. Plant height of Rice at 15, 30 and 45 days after transplanting.

Varieties	Methods	15 days	30 days	45 days
Neang Kong	Control	22.76 ab	26.84 d	39.50 bc
	Organic	24.46 a	32.26 ab	59.59 a
	GAP	22.95 ab	31.16 abc	40.69 bc
	Chemical	19.43 c	27.46 cd	61.84 a
Kea	Control	21.14 bc	26.36 d	37.26 c
	Organic	22.74 ab	29.40 bcd	43.89 bc
	GAP	21.76 bc	27.15 d	53.55 ab
	Chemical	20.62 bc	33.56 a	64.51a
CV(%)		4.15	5.08	11.06

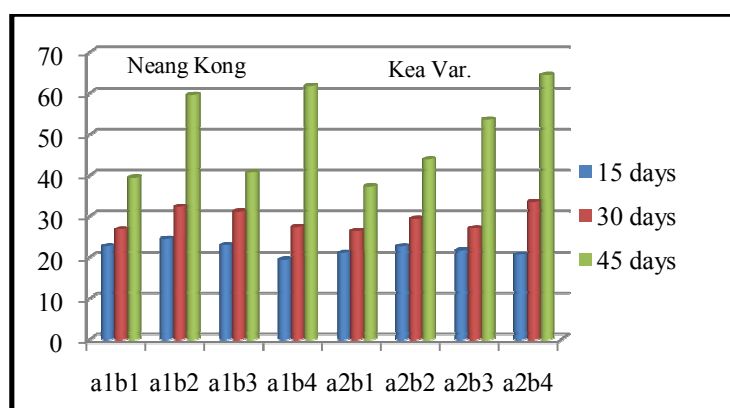


Fig 1. Plant height of Rice at 15, 30 and 45 days after transplanting

It is confirmed that the agricultural inputs used in organic method would be effective for organic crop production according to the report of Kwaechai et al. (2009). In this study, it was observed that the Kea variety showed lower plant growth parameters in plant height, tiller, panicles, and yield compared to the Neang Kong variety, which is possibly due to an attack from insects and pathogens. The Kea variety is more susceptible than the Neang Kong variety. As reported by Soyong, *et al* (2010), the application of CM products for disease control and plant stimulation in organic rice production can reduce disease incidence and improve plant growth.

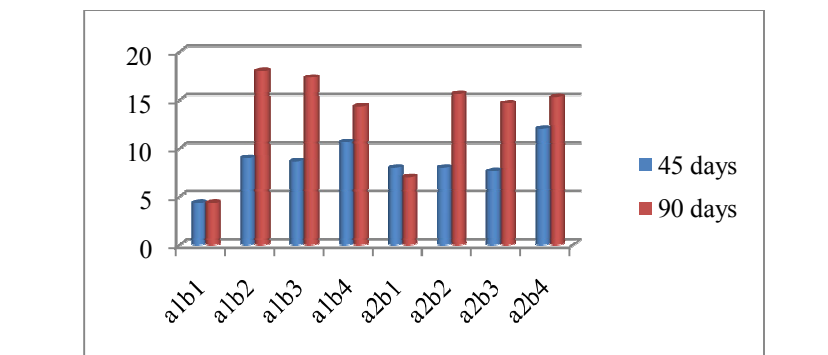


Fig 2. Number of tiller of Rice at 15 and 45 day after transplanting

Table 2. Plant growth parameters at 90 day at harvesting

Varities	Methods	Tillers	Number of Panicle	Yield (g)
Neang Kong	Control	4.33 b	57 c	666 d
	Organic	18.00 a	156 b	2866 a
	GAP	17.33 a	176 ab	2533 ab
	Chemical	14.33 a	200 a	2500 ab
Kea	Control	7.00 b	76 c	966 d
	Organic	15.66 a	148 b	1933 c
	GAP	14.66 a	154 b	1900 c
	Chemical	15.33 a	172 ab	2033 bc
CV %		11.10	8.65	11.01

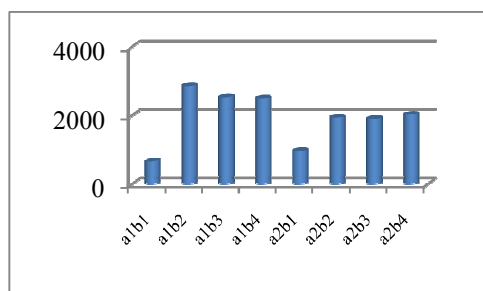


Fig 3. Fresh weight of stem after transplanting

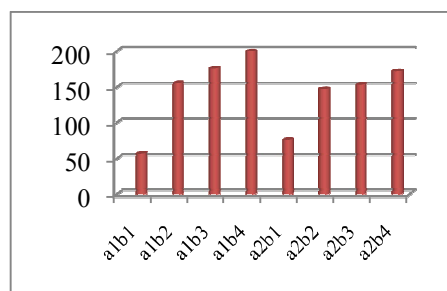


Fig 4. Number of panicle after transplanting

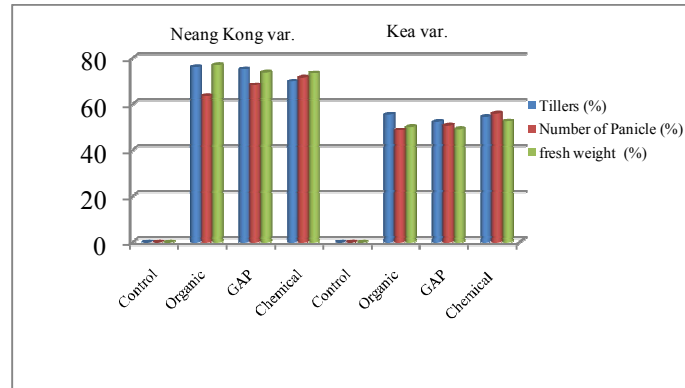


Fig 5. Percentage of increased in plant growth parameters of Rice

In Neang Kong variety, the tillers, panicles and fresh weight of seeds or yield were increased after using organic methods of 75.94, 63.46, 76.76 %, respectively. GAP method could increase the tillers, panicles and yield of 75.01, 68.18 and 73.70 %, respectively. Chemical method could also increase in the tillers, panicles and yield of 68.78, 71.50 and 73.36 %, respectively when compared to the non-treated control. In Kea variety, the tillers, panicles and fresh weight of seeds or yield were increased after using organic methods of 55.33, 48.64, 60.02 %, respectively (Table 2, Figs. 2, 3 and 4) GAP method could increase the tillers, panicles and yield of 52.25, 50.64 and 49.15 %, respectively. Chemical method could also increase in the tillers, panicles and yield of 55.33, 55.81 and 52.48 %, respectively when compared to the non-treated control. As reports by Chalee (2005), Sibounnavong *et al.*, (2006) and Soyong *et al.*, (2010) that organic crop production would be successful performed if it provided the effective agricultural inputs.

Table 2. Percent of increased in plant growth parameters after treatments.

Varities	Methods	Tillers	Number of Panicle	Yield (g)
Neang Kong	Control	-	-	-
	Organic	75.94	63.46	76.76
	GAP	75.01	68.18	73.70
	Chemical	69.78	71.50	73.36
Kea	Control	-	-	-
	Organic	55.30	48.64	50.02
	GAP	52.25	50.64	49.15
	Chemical	54.33	55.81	52.48

Organic and chemicals are not significantly different in plant height but significantly differed from GAP method and non-treated control. Plant height in

organic and chemical methods in rice var Neang Kong were not significant differed from GAP method but significantly different from non-treated control. The chemical method in rice var Kea gave significantly highest in plant height and followed by GAP and organic methods when compared to the non-treated control. Moreover, the organic, GAP and chemical methods are not significantly different in tiller number at 90 days after planting but significantly differed from non-treated control. The organic, GAP and chemical methods in rice var Kea at 90 days were not significantly different in tiller number but significantly differed to the non-treated control. Both varieties of Neang Kong and Kea, the tillers, panicles and fresh weight of seeds or yield were increased after using organic, GAP and chemical methods could increase the tillers, panicles and yield when compared to the non-treated control.

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