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Chemical fertilizer enhances growth, yield and quality of two varieties of muskmelon (*Cucumis melo* L.)

Benjapon Kunlanit[1,2*], Ruchuon Wanna[1,2], Phirayot Khaengkhan[1,2], Darika Bunphan[1,2], Tanapon Siritrakulsak[1], Somchai Butnan[3] and Tuan Vu Dinh[4]

[1]Department of Agricultural Technology, Faculty of Technology, Mahasarakham University, Maha Sarakham 44150, Thailand
[2]Resource Management in Agricultural Technology Research Unit, Mahasarakham University, Maha Sarakham 44150, Thailand
[3]Department of Plant science, Faculty of Agricultural Technology, Sakon Nakhon Rajabhat University, Sakon Nakhon 47000, Thailand
[4]Institute of Biotechnology and Environment, Nha Trang University, 02 Nguyen Dinh Chieu, Nha Trang City, Khanh Hoa Province, Viet Nam

***Corresponding author: Benjapon Kunlanit**

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Abstract: This study aimed to investigate the effects of chemical fertilizer on the growth, yield, and quality of two varieties of muskmelon. A 2×4 split-plot design with four replications was employed. The factors included two Thai muskmelon varieties (Nan and Homlamon) and four chemical fertilizer rates: 1) no fertilizer (CF1), 2) N-P-K rate of 18.75-15-15 kg ha^{-1} (CF2), 3) N-P-K rate of 37.50-30-30 kg ha^{-1} (CF3), and 4) N-P-K rate of 56.25-45-45 kg ha^{-1} (CF4). The muskmelons were grown in loamy sandy soil on a farmer's field from December 2023 to March 2024. Growth, yield, and quality parameters were measured. The results indicated that CF3 and CF4 significantly enhanced growth, yield, and quality parameters (e.g., total soluble solids and fruit firmness) in both varieties compared to other treatments. In terms of economic return, CF3 was recommended for the Nan variety, while CF4 was recommended for the Homlamon variety, as these treatments provided the highest economic returns. This study suggests that the two muskmelon varieties have different chemical fertilizer requirements for optimal performance.

Keywords: Northeast Thailand; muskmelon; chemical fertilizer; economic return; loamy sand soil.
Abbreviations: ANOVA _Analysis of variance; CV_ Coefficient of variation; EC_Electrical conductivity; LSD_Least significant difference; N_Nitrogen; OM_Organic matter; P_Phosphorus

Introduction

Muskmelon, scientifically referred to as *Cucumis melo* L., is a significant horticultural crop grown in various forms such as cantaloupe, honeydew, casaba, Persian melon and Crenshaw across tropical, sub-tropical and temperate regions worldwide (Nayar and Singh, 1998). Its global production amounts to around 28 million tons (FAOSTAT, 2010). Belonging to the Cucurbitaceae plant family, muskmelon is mainly cultivated for its nutritional value and pleasant aroma, aside from its numerous health benefits. With its fruit containing 90% water, consuming its refreshing and sweet pulp with a pleasant aroma proves effective in preventing dehydration, especially in dry and hot climates, and alleviating constipation. Moreover, muskmelon is abundant in essential nutrients like vitamin C, carotene, folic acid, potassium (K), and various health-bioactive compounds. Folic acid supports healthy fetal development in pregnant women and assists in the prevention of cervical cancer and osteoporosis, while potassium is linked to the reduction of blood pressure (Lester and Hodges, 2008).

The effectiveness of mineral nutrition and the application of inorganic fertilizers as nutrient sources to enhance the growth and productivity of cucurbit crops is well-established (Nerson, 2008). Primary nutrient [Nitrogen (N), phosphorus (P) and K] applications have shown similar positive effects on the growth and yield of all cucurbits in field conditions (Siva et al., 2017). The utilization of NPK fertilizers significantly impacts fruit weight, fruit quantity, vine length and overall fruit yield per hectare (Jan et al., 2000; Jilani et al., 2009; Rahul et al., 2010; Wahocho et al., 2017). Studies conducted by Oloyode and Adebooye (2013) on pumpkin (*Cucurbita pepo* Linn.) and Awere and Onyeacholem (2014) on watermelon (*Citrullus lanatus*) demonstrated notable growth and yield improvements with the application of NPK fertilizers compared to unfertilized crops. In researches focusing on muskmelon cultivated in loamy sand soil, Aluko (2020; 2021) observed that the application of NPK at a rate of 333 kg ha^{-1} resulted in increased fruit quantity, longer fruit length, larger fruit diameter and higher total fruit weight compared to plots without NPK addition but it did not significant differences from a rate of 500 kg ha^{-1} (Aluko, 2021).

There are several muskmelon varieties grown in Thailand, only five (Singapore, Sithong, Monthong, Nan and Homlamon) are widely cultivated. This study focused on two of these varieties, including Nan and Homlamon since they provide high fruit yield and require low water supply. In addition, these varieties can be cultivated in all year round. Most upland soils in Northeast Thailand are sandy, with low organic matter and deficient in primary nutrients (NPK) (Vityakon et al., 2000). To determine the optimal NPK fertilizer rates for growing muskmelon on tropical sandy soils after rice harvest, the study aimed to examine the effects of NPK fertilizer on the growth, yield, quality and economic returns of the Nan and Homlamon varieties.

Table 1. Soil properties before plating muskmelon.

Parameter	Value	Classification
Soil texture	Loamy sand	-
Soil pH (Soil: H_2O, 1: 2.5)	5.22	Weakly acidic
Electrical conductivity (dS m^{-1})	0.26	Non-saline
Total nitrogen (%)	0.03	Very low
Available phosphorus (mg kg^{-1})	6.50	Low
Exchangeable potassium (mg kg^{-1})	78.00	Medium

Table 2. Plant height (cm) as influenced by applied different chemical fertilizer rates.

Treatment	25 DAT	50 DAT	75 DAT
Variety (V)			
Nan (V1)	20.23	58.59	69.74
Homlamon (V2)	23.26	60.92	70.78
N-P-K rate (kg ha^{-1}) (CF)			
0-0-0 (CF1)	14.57 b	46.67 c	54.98 d
18.75-15-15 (CF2)	22.20 a	59.38 b	68.27 c
37.50-30-30 (CF3)	24.43 a	64.63 a	74.97 b
56.25-45-45 (CF4)	25.78 a	68.33 a	82.82 a
V x CF			
V1 x CF1	14.43	47.33	55.23
V1 x CF2	18.37	57.60	68.40
V1 x CF3	23.77	63.57	74.40
V1 x CF4	24.37	65.87	80.93
V2 x CF1	14.70	46.00	54.73
V2 x CF2	26.03	61.17	68.13
V2 x CF3	25.10	65.70	75.53
V2 x CF4	27.20	70.80	84.70
F-test: V	ns	ns	ns
F-test: CF	**	**	**
F-test: V x CF	ns	ns	ns
CV (%): V	15.92	3.65	3.34
CV (%): V x CF	14.62	4.11	3.57

Means in the same column followed by different lowercase letters are significantly different by LSD ($P \leq 0.01$); ns: represents not significantly different ($P > 0.05$).

Results and discussion

Soil properties before muskmelon planting

The soil at the experimental site before planting muskmelons was classified as sandy loam, with a pH of 5.22, an electrical conductivity (EC) of 0.26 dS m^{-1}, and a total nitrogen (N) content of 0.03% (Table 1). The available phosphorus (P) was 6.50 mg kg^{-1}, while the exchangeable potassium (K) was 78.00 mg kg^{-1}. The soil was strongly acidic, non-saline, and characterized by very low N, moderate P, and high K levels.

According to the chemical properties described by Sanchez et al. (2003), the soil in this study was considered infertile as it lacked sufficient essential nutrients for optimal crop growth. Therefore, the application of chemical fertilizers is necessary to enhance the growth and yield of muskmelons.

Goutam et al. (2020) and Pansare et al. (2023) reported that muskmelon thrives in deep, fertile, well-drained soils with a loamy to sandy loamy texture and a pH range of 6.0 to 7.5. However, muskmelon cultivation is unsuitable for soils with inadequate drainage. Early crops can be achieved on lighter soils (sandy or sandy loam), whereas heavier soils (clay loam) produce higher yields but are better suited for the later season (Meena et al., 2018).

Growth attributes of muskmelon

Muskmelon varieties and their interaction with chemical fertilizer rates showed no significant differences ($P > 0.05$) in plant height, vine number per plant, canopy size, vine dry weight, and chlorophyll (SPAD) content (Tables 2, 3, and 4). However, fertilizer application significantly improved these parameters compared to no fertilizer application (CF1) ($P \leq 0.01$), with the highest NPK rate (CF4) yielding the best results.

NPK fertilizers are essential for plant growth, supporting critical physiological processes (Marschner, 1995). Proper nutrient balance and availability are vital for optimal growth. In this study, CF4 provided the best growth performance for both muskmelon varieties, consistent with findings by Aluko (2020; 2021) and Aluko et al. (2021), who reported that applying NPK 15-15-15 at 333 kg ha^{-1} significantly enhanced muskmelon growth in loamy sand soils compared to no fertilizer. Similarly, Dixit et al. (2023) reported that applying 100-60-60 kg NPK ha^{-1} produced the longest vines, highest chlorophyll content, and most branches in muskmelon. Wahocho et al. (2017) also observed significant vegetative improvements with 50 kg N ha^{-1}. In contrast, Rungruksatham and Khurnpoon (2016) found no significant differences in muskmelon growth parameters between chemical and organic fertilizers in Thailand.

Research on other crops supports these findings. Oloyode and Adebooye (2013) on pumpkin (*Cucurbita pepo* Linn.) and Awere and Onyeacholem (2014) on watermelon (*Citrullus lanatus*) reported substantial growth improvements with NPK fertilizer compared to unfertilized crops. Kacha et al. (2017) observed increased branches, nodes, and vine lengths in watermelon with 125-100-60 kg NPK ha^{-1}.

Yield component and yield of muskmelon

Muskmelon varieties, chemical fertilizer rates and interaction between muskmelon varieties and chemical fertilizer rates were significantly different ($P \leq 0.01$) for diameter, length, number and fresh weight of fruits (Table 5).

Homlamon variety had higher fruit diameter and fruit number than Nan variety, meanwhile, Nan variety had higher fruit length and fruit fresh weight ($P \leq 0.05$, $P \leq 0.01$) (Table 5). When considering the rates of chemical fertilizer input, CF4 had highest fruit diameter, fruit length and fruit fresh weight as compared to the other treatments ($P \leq 0.01$), whereas, fruit numbers under CF3 and CF2 were higher than under the other treatments ($P \leq 0.01$).

Muskmelon varieties were significantly different ($P \leq 0.01$) for harvest index, and chemical fertilizer rates were also significantly

Table 3. Vine length, canopy size and vine dry weight of vines as influenced by applied different chemical fertilizer rates.

Treatment	Vine no. (vine plant^{-1})	Canopy size (cm)	Vine dry weight (kg ha^{-1})
Variety (V)			
Nan (V1)	2.6	112.62	3,599
Homlamon (V2)	2.5	113.23	3,582
N-P-K rate (kg ha^{-1}) (CF)			
0-0-0 (CF1)	2.0 c	74.53 d	3,372 c
18.75-15-15 (CF2)	2.6 b	120.88 c	3,545 b
37.50-30-30 (CF3)	2.7 ab	125.20 b	3,696 a
56.25-45-45 (CF4)	2.9 a	131.08 a	3,750 a
V x CF			
V1 x CF1	2.2	73.67	3,356
V1 x CF2	2.6	121.13	3,550
V1 x CF3	2.7	125.63	3,723
V1 x CF4	2.9	130.07	3,768
V2 x CF1	1.8	75.40	3,388
V2 x CF2	2.6	120.63	3,539
V2 x CF3	2.7	124.77	3,669
V2 x CF4	3.0	132.10	3,732
F-test: V	ns	ns	ns
F-test: CF	**	**	**
F-test: V x CF	ns	ns	ns
CV (%): V	9.25	1.75	3.68
CV (%): V x CF	8.67	2.00	2.85

Means in the same column followed by different lowercase letters are significantly different by LSD (P≤0.01). ns represents not significantly different (P>0.05).

Table 4. Chlorophyll content (SPAD) as influenced by applied different chemical fertilizer rates.

Treatment	25 DAT	50 DAT	75 DAT
Variety (V)			
Nan (V1)	55.31	53.77	52.61
Homlamon (V2)	54.36	53.63	52.78
N-P-K rate (kg ha^{-1}) (CF)			
0-0-0 (CF1)	47.47 d	46.17 d	45.28 d
18.75-15-15 (CF2)	54.58 c	54.05 c	53.78 c
37.50-30-30 (CF3)	57.55 b	56.51 b	54.90 b
56.25-45-45 (CF4)	59.73 a	58.05 a	56.82 a
V x CF			
V1 x CF1	47.90	46.03	45.43
V1 x CF2	55.37	54.83	53.70
V1 x CF3	58.03	56.33	54.80
V1 x CF4	59.93	57.87	57.20
V2 x CF1	47.03	46.30	45.13
V2 x CF2	53.80	53.27	53.87
V2 x CF3	57.07	56.70	55.00
V2 x CF4	59.53	58.23	56.43
F-test: V	ns	ns	ns
F-test: CF	**	**	**
F-test: V x CF	ns	ns	ns
CV (%): V	2.16	1.60	0.42
CV (%): V x CF	2.03	1.30	0.99

Means in the same column followed by different lowercase letters are significantly different by LSD (P≤0.01). ns represents not significantly different (P>0.05).

different (P≤0.01) for this attribute (Table 6). Nan variety had higher harvest index than Homlamon variety (P≤0.01). When considering the rates of chemical fertilizer application, CF2 and CF3 had significantly higher harvest index than other treatments (P≤0.01). Interaction between muskmelon varieties and chemical fertilizer rates was significantly different for harvest index (P≤0.01).

The appropriate NPK rates (CF3 and CF4) are essential for improving muskmelon fruit yield (Table 5). Our results are consistent with several previous studies, which found that NPK application led to higher yield components and overall yield compared to no fertilizer application (Wahocho et al, 2017; Castellanos et al., 2011; Sabo et al., 2013; Oga and Umekwe, 2015). Aluko (2020; 2021) and Aluko et al. (2021) reported that applying NPK 15-15-15 at 333 kg ha^{-1} improved muskmelon yield and components in loamy sand soils. Similarly, Zahedyan et al. (2021) found that 180 kg ha^{-1} of NPK enhanced muskmelon yield components. Grasso et al. (2022) observed that increasing nitrogen (228-582 kg N ha^{-1}) boosted muskmelon yield in varieties Tezac, Magiar, and Jacobo. In Thailand, Rungruksatham and Khurnpoon (2016) found that chemical fertilizers resulted in higher yield parameters, such as fruit weight and volume, compared to organic fertilizers. Awere and Onyeacholem (2014) also reported that 400 kg ha^{-1} of NPK 20-10-10 produced the best watermelon yield.

Fruit quality of muskmelon

Muskmelon varieties were significantly different (P≤0.01) for total soluble solids (°brix), and chemical fertilizer rates were also significantly different (P≤0.01) for this trait (Table 6). Homlamon variety had higher harvest index than Nan variety (P≤0.01). Application of 37.50-30-30 kg N-P-K ha^{-1} (CF4) had significantly

Table 5. Diameter, length, number and fresh weight of fruits as influenced by applied different chemical fertilizer rates.

Treatment	Fruit diameter (cm)	Fruit length (cm)	Fruit no. (fruit plant^{-1})	Fruit fresh weight (kg ha^{-1})
Variety (V)				
Nan (V1)	7.50 b	15.27 a	1.00 b	7,742 a
Homlamon (V2)	9.44 a	9.31 b	2.29 a	5,171 b
N-P-K rate (kg ha^{-1}) (CF)				
0-0-0 (CF1)	4.01 d	6.08 d	0.47 c	3,003 c
18.75-15-15 (CF2)	5.91 c	13.32 c	1.92 ab	6,459 b
37.50-30-30 (CF3)	10.01 b	14.42 b	2.31 a	8,123 a
56.25-45-45 (CF4)	10.37 a	15.34 a	1.89 b	8,241 a
V x CF				
V1 x CF1	3.86 g	8.32 g	0.44 c	2,721 g
V1 x CF2	7.88 e	15.45 c	1.00 b	7,593 c
V1 x CF3	9.70 c	19.83 a	1.44 b	10,952 a
V1 x CF4	8.57 d	17.48 b	1.11 b	9,701 b
V2 x CF1	4.15 f	3.83 h	0.50 bc	3,284 f
V2 x CF2	11.13 b	11.19 e	2.84 a	5,325 e
V2 x CF3	11.04 b	10.85 f	3.17 a	5,529 e
V2 x CF4	11.45 a	11.35 d	2.67 a	6,544 d
F-test: V	**	**	*	**
F-test: CF	**	**	**	**
F-test: V x CF	**	**	**	**
CV (%): V	0.41	0.40	31.20	2.34
CV (%): V x CF	0.62	0.33	18.94	5.11

Means in the same column followed by different lowercase letters are significantly different by LSD (P≤0.01; ≤0.05).

Table 6. Harvest index, total soluble solids and firmness of fresh fruit as influenced by applied different chemical fertilizer rates.

Treatment	Harvest index	Total soluble solids (°brix)	Firmness of fresh fruit (kg cm^{-2})
Variety (V)			
Nan (V1)	0.46 a	8.00 b	0.16
Homlamon (V2)	0.39 b	9.56 a	0.17
N-P-K rate (kg ha^{-1}) (CF)			
0-0-0 (CF1)	0.30 c	6.60 d	0.12 c
18.75-15-15 (CF2)	0.44 b	9.08 c	0.16 b
37.50-30-30 (CF3)	0.49 a	9.29 b	0.19 a
56.25-45-45 (CF4)	0.49 a	10.15 a	0.20 a
V x CF			
V1 x CF1	0.27 g	6.15 g	0.12
V1 x CF2	0.48 c	8.13 e	0.17
V1 x CF3	0.57 a	8.52 d	0.19
V1 x CF4	0.53 b	9.22 c	0.21
V2 x CF1	0.32 f	7.04 f	0.12
V2 x CF2	0.40 e	10.02 b	0.16
V2 x CF3	0.40 e	10.06 b	0.18
V2 x CF4	0.43 d	11.09 b	0.19
F-test: V	**	**	ns
F-test: CF	**	**	**
F-test: V x CF	**	**	ns
CV (%): V	0.83	2.25	14.83
CV (%): V x CF	2.73	1.30	8.31

Means in the same column followed by different lowercase letters are significantly different by LSD (P≤0.01). ns represents not significantly different (P>0.05).

higher harvest index than other treatments (P≤0.01). Interaction between muskmelon varieties and chemical fertilizer rates was significantly different for total soluble solids (P≤0.01).

Muskmelon varieties and interaction between muskmelon varieties and chemical fertilizer rates were not significantly different (P>0.05) for firmness of fresh fruit (Table 6). However, chemical fertilizer rates were significantly different (P≤0.01) for firmness of fresh fruit.

Sufficient NPK nutrients are essential for improving crop quality (Marschner, 1995). Our findings indicate that higher NPK rates (CF3 and CF4) enhance muskmelon fruit quality. Similarly, Grasso et al. (2022) found that applying 57-61 kg N ha^{-1} resulted in higher total soluble solids (% Brix) in muskmelon compared to 228-582 kg N ha^{-1}, although nitrogen application did not significantly affect fruit firmness. Zahedyan et al. (2021) found that 180 kg ha^{-1} of NPK improved fruit firmness, total soluble solids and vitamin C content than the lower application rates in muskmelon. In Thailand, Rungruksatham and Khurnpoon (2016) reported that chemical fertilizers increased total soluble solids more than organic fertilizers, though there was no significant difference in fruit firmness. For pineapple, Spironello et al. (2004) found that increasing potassium levels enhanced total soluble solids.

Economic return

Economic returns for two muskmelon varieties were analyzed separately (Table 7). Chemical fertilizer rates significantly affected fresh fruit yield, yield value, and economic return over fertilizer cost for both varieties (P≤0.01). All chemical fertilizer rates outperformed no fertilizer (CF1) in terms of fresh fruit yield, yield value, and economic return. As chemical fertilizer rates increased, both fresh fruit yield and economic return improved for both varieties. For the Nan variety, the highest yield value and economic return were achieved with a chemical fertilizer rate of 37.50-30-30 kg N-P-K ha^{-1}, while the lowest was observed with no fertilizer (CF1).

Table 7. Means for fresh fruit yield, yield value and economic return over fertilizer cost of two muskmelon varieties as affected by applied different chemical fertilizer rates.

N-P-K rate (kg ha^{-1})	Fertilizer Value (USD ha^{-1})	Fresh fruit yield (kg ha^{-1})		Yield value (USD ha^{-1})		Economic return over fertilizer cost (USD ha^{-1})	
		V1$^{/1}$	V2$^{/2}$	V1	V2	V1	V2
0-0-0	0	2,721 c	3,284 c	2,993 c	3,613 c	2,993 c	3,613 c
18.75-15-15	41.64	7,593 b	5,325 b	8,353 b	5,857 b	8,311 b (178%)	5,816 b (61%)
37.50-30-30	83.28	10,952 a	5,530 b	12,047 a	6,083 b	11,964 a (300%)	5,999 b (66%)
56.25-45-45	124.92	9,701 a	6,544 a	10,671 a	7,199 a	10,546 a (252%)	7,074 a (96%)
F-test		**	**	**	**	**	**
CV (%)		5.82	2.34	5.82	2.34	5.82	2.34

V1$^{/1}$= Nan variety. V2$^{/2}$= Homlamon variety. Means in the same column followed by different lowercase letters are significantly different by LSD (P≤0.01). The cost of the chemical fertilizer formulas 46-0-0, 18-46-0 and 0-0-60, used for the applied fertilizer treatments, was 23.47, 33.13 and 32.50 USD 50 kg^{-1}, respectively. The cost of muskmelon in 2024 was 1.10 USD kg^{-1}. Number in parenthesis is % increase of fresh fruit yield and economic return over fertilizer costs compared to the no chemical fertilizer application

Therefore, the optimal rate for Nan variety was 37.50-30-30 kg N-P-K ha^{-1}. In contrast, the Homlamon variety had the highest fresh fruit yield, yield value, and economic return at a chemical fertilizer rate of 56.25-45-45 kg N-P-K ha^{-1}, making it the optimal rate for this variety under the experimental conditions.

In China, Uhm et al. (2012) found that optimized fertilization, with organic fertilizer replacing 15% or 30% of chemical fertilizer, resulted in profit increases of 1.23, 5.84, and 11.5%, respectively, for muskmelon. Kumar et al. (2007) reported that applying 40 kg N ha^{-1} and 32 kg P ha^{-1} resulted in higher net profit for long melon compared to both lower and higher NP application rates. Similarly, Lyocks et al. (2020) found that applying 30 kg ha^{-1} of NPK 20-10-10 fertilizer in watermelon resulted in higher yield value and net profit compared to no fertilizer or higher rates. Law-Ogbomo and Ekunwe (2011) reported that 200 kg NPK 15:15:15 ha^{-1} resulted in optimum economic returns from maize/melon intercrops.

Based on our results, the Nan variety and a chemical fertilizer rate of 37.50-30-30 kg N-P-K ha^{-1} are highly recommended for muskmelon production following paddy rice harvest in loamy sand soils in Northeast Thailand.

Materials and methods

Treatments and experimental design

Field experiment was conducted in a farmer's field located in Chiang Yuen district, Maha Sarakham province in the Northeast Thailand (16°22'53"N, 103°9'4"3E, 150 masl). The average rainfall was 778.71 mm yr^{-1}, and the average temperature was 27.4°C. A 2×4 split plot design with four replications was used. Two muskmelon varieties consisting of Nan (V1) and Homlamon (V2) varieties were assigned in main plots and four chemical fertilizer rates consisting of 0-0-0 (CF1), 18.75-15-15 (CF2), 37.50-30-30 (CF3) and 56.25-45-45 (CF4) kg N-P-K ha^{-1} were assigned in subplots. Chemical fertilizer formula 46-0-0, 18-46-0 and 0-0-60 was applied as N, P and K sources, respectively. In all treatments, farmyard manure at the rate of 6.5 t ha^{-1} was incorporated to soil of each plot for 10 days before muskmelon seedling transplanting. Chemical fertilizer, applied in soils according to the treatments, was applied twice: first half once three days after transplanting (basal fertilizer) and second half again 20 days after transplanting.

Crop management

The soil was ploughed twice to form ridges at the distance of 1 m and 2 m apart from each other. The experimental area was divided into 24 plots with plot size of 2 × 3 m^2. Two soil ridges between plots were used as an alley, and the alley between replications was 2 m wide.

Two muskmelon varieties (Nan and Homlamon) were selected in this study because they are popular in Thailand. In addition, these varieties produce a high fruit yield, require minimal water, and can be cultivated year-round. Nan variety has long-fruited muskmelon, and Homlamon variety has round-fruited muskmelon. The crop was planted in the dry season in the farmer's field after rice harvest in December 2023. Muskmelon seedlings ages 25 days were transplanted at a spacing of 1 m × 1 m with one plant per hill, 6 plants in a plot and population density of 10,000 plants per hectare. Weed control was done every 15 days after transplanting. Furrow irrigation system was available to supply water to the crop every few days after transplanting. There was no rain during crop growth.

Soil sampling and analysis

Topsoil (0-20 cm) samples of the experimental site was collected before transplanting. The soil samples were determined for physical and chemical properties including soil texture (hydrometer method), pH (1:2.5; soil: H_2O), electrical conductivity (EC, 1:2.5; soil: H_2O), total N (micro-Kjeldahl method), available P (Bray II extractant) and exchangeable K (1 *N* NH_4 OAc extractant) (Jones, 2001).

Measurements and analysis at the harvesting stage

Three months after transplanting all fruits in the plot were harvested. Measurements at the harvesting stage included vine fresh weight, fruit number, fruit fresh weight, fruit length, fruit diameter, total soluble solids, firmness and harvest index. Fresh weights of shoots and fruit fresh weight were recorded in the field. The samples of shoots with 3 kg for each sample were oven-dried at 40°C until the weights were constant, and dry weights of the samples were recoded. Then dry weights of the samples were converted to dry weights of the plots. Harvest index was calculated by dividing fruit fresh weight by total fresh weight (both fruits and shoots). Fresh fruit samples of 3 fruits in each plot were randomly sampled and used for determination of total soluble solids (°brix) using an Atago N-1E Hand Refractometer and for fruit firmness using a Bareiss fruit firmness tester.

Statistical analysis

Data for each parameter were analyzed statistically using analysis of variance (ANOVA) with Statistix 10 according to the experimental design. Means were separated by least significant difference (LSD) at 0.05 and 0.01 probability levels.

Conclusions

This study was to investigate the effects of chemical fertilizers on the growth, yield, and quality of two muskmelon varieties. The N-P-K rates of 37.50-30-30 kg ha^{-1} and 56.25-45-45 kg ha^{-1} resulted in superior growth, yield, and quality parameters for both varieties, Nan and Homlamon. Based on economic returns, an N-P-K rate of 37.50-30-30 kg ha^{-1} was recommended for the Nan variety, while a rate of 56.25-45-45 kg ha^{-1} was recommended for the Homlamon variety, as these treatments provided the highest profitability.

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Statement of contributions

BK was responsible for the experimental design and project coordination. RW contributed to data collection and analysis. PK handled the methodology and statistical evaluations. DB assisted with manuscript preparation and data interpretation. TS played a role in supervising laboratory experiments. SB provided resources and critical revisions to the manuscript. TVD contributed to conceptualization and provided overall guidance throughout the study.

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