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Correlation of plant nutrients uptake with shallot production in alluvial soils

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Abstract. Plant analysis can be used as a guide to diagnose status and as a fertilizer recommendation tool for shallot. This study aims to determine the nutrient requirements of shallot based uptake of N, P and K on alluvial soil, to understand the correlation between nutrients uptake and bulb yield, and also to know the nutrients status of shallot varieties. Research activities had been carried out at two locations: Cirebon (West Java) and Brebes (Central Java) with alluvial soil types, from May to August 2010. The experimental design at each location was a Split Plot Design with three replications. The main plots were varieties, viz Bima and Bangkok. The subplots were doses of N, P and K fertilizer, consisting of six combinations of fertilizer N, P and K fertilizer dosage range is 85-255 kg N/ha, 0-150 kg P_2O_5/ha and 0-180 kg K_2O/ha. The results showed that the alluvial soil has low N, very high P and K status. The response of plant growth, bulb yield and nutrients uptake (N, P and K) of Bima and Bangkok were relatively similar to the application of N, P and K fertilizer. Bima has plant growth, bulb yield, nutrients uptake, and efficiency of fertilizers lower than Bangkok. Application of N, P and K fertilizer in the dose range 85-255 kg N/ha, 0-150 kg P_2O_5/ha and 0-180 kg K_2O/ha had no significantly difference on growth and bulb yield. Fertilizer requirements for Bima was 160 kg N/ha, 90 kg P_2O_5/ha and 121 kg K_2O/ha, meanwhile Brebes was 170 kg N/ha, 83 kg P_2O5/ha and 138 kg K_2O/ha. Correlation of N, P uptake on Bima and Bangkok production were quadratic. Meanwhile, P uptake was quadratic for Bima and linier for Bangkok. The nutrient status of Bima was sufficient for N, P_2O_5 and very high for K_2O. Meanwhile the nutrient status of Bangkok was very high for N and P_2O_5.

Key Words: Plant analysis, *Allium cepa* var *aggregatum*, fertilizer recommendation, efficiency of fertilizer, NPK fertilizer.

Introduction. Shallot (*Allium cepa* var *aggregatum*) can grow and produce bulbs in the lowlands to the highlands. However, in general, shallot cultivated in the lowlands on alluvial soil types (71%), in the medium on Latosol soil types (16%) and in the highlands on Andisol or associates Andisol – Latosol soil types (13%). The diversity of soil and environment are quite high in Indonesia led fertilizers needs differ from one location to another. One attempt to improve land productivity and crop onion is the improvement of soil fertility through fertilization. Rational and scientific fertilization must be based from potential or nutrient status and plants need (Liferdi 2010).

There are many reports about N, P and K fertilizers which describe increase of the onion yield (Hidayat & Rosliani 1996; Gunadi & Suwandi 1989). Shallots need balance of NPK nutrient supply to get optimal plant growth and bulb yield (Sumarni et al 2012). Fertilization is required to support nutrition, endurance, and plant production. Inorganic fertilizer application at a dose of plant needs will not disturb the balance of the environment (Izhar et al 2013). But so far, the farmers still fertilize by habit and experience, and not based on the recommended dosage of soil testing and nutrient uptake. This causes ineffective and inefficient use of fertilizers, and the last will damage the environment (Thamrin et al 2013). To know the N, P and K needs on specific location, we must understand relationship between the value of soil data with a dose of nutrient application and plant nutrients uptake for optimum results. According to Cotteine (1980)

the test results in one location only measure availability of the nutrient but not show the nutrients need.

Besides fertilizing, bulbs production are also determined by genetic factors such as the varieties used. The results showed that the varieties of Bangkok give bulb yield higher than the Kuning or Timor varieties (Basuki et al 2003). There is a possibility that Bangkok needs more N, P and K fertilizer than Kuning or Timor to provide optimum bulb yields. Based on relationship between dose of N, P, K fertilizer and bulb yields, it is known that the optimum dosage is 146 kg N/ha, 110 kg P_2O_5/ha and 100 kg K_2O/ha for Bima varieties, whereas for Bangkok varieties is 248 kg N/ha, 98 kg P_2O_5 /ha and 97 kg K_2O/ha (Sumarni et al 2006). There is a tendency that the lands on the northern coast of Brebes does not require fertilizer P and K (Basuki et al 2003), because the experiment site in Brebes is already saturated in P and K nutrients, which are characterized by high available P (Olsen extract) and K - available (Morgan extract), so that the addition of P and K fertilizers do not improve significantly the results on shallot bulbs.

This study aims to determine the nutrient requirements of shallot based uptake of N, P and K on alluvial soil, to understand the correlation between nutrients uptake and bulb yield, and also to know the nutrients status of shallot varieties.

Material and Method. The experiment was conducted in Cirebon (West Java) and Brebes (Central Java) with alluvial soil types, from May to August 2010. The experimental design used Split Plot design with three replications. The main plot is the shallot varieties (A), consisting of Bima (a1) and Bangkok (a2). The subplots were doses of fertilizer N, P and K (B) consisting of 6-dose combination of N - P_2O_5 - K_2O (Table 1). Dose of N - P_2O_5 - K_2O is an average of the results of fertilization in previous conducted experiments on shallot (Sumarni et al 2005, 2006; Hilman et al 2014).

Table 1

Treatments dose combination of N, P_2O_5 and K_2O

Treatments	*N (kg/ha)*	*P_2O_5 (kg/ha)*	*K_2O (kg/ha)*
b1	85	50	60
b2*	170	100	120
b3	255	150	180
b4	85	0	0
b5	170	0	0
b6	255	0	0

* Optimum dose of N-P_2O_5-K_2O based on previous studies (Sumarni et al 2005, 2006; Hilman et al 2014).

Shallot was grown in experimental plots measuring 1.5 m x 4 m = 6 m^2, with a spacing of 15 cm x 20 cm, the recomended plant spacing between plnts and rows for shallot cultivation (Hidayat & Rosliani 2003). Plant population was 200 plants per plot. P fertilizer (SP – 36 content 35% P_2O_5) given once before planting, by broadcasting and mixed with soil. N fertilizer (urea content 46% N + ZA content 21% N) and K fertilizer (KCl content 60% K_2O) provided in plant rows given 2 times at 15 and 30 days after planting, each half of the prescribed dose. Plant maintenance such as watering, weeding and pest and disease control was conducted intensive and adapted to the conditions of the plants in the field.

The measured parameters included:

1. Growth of the plant consists of plant height, number of tillers and plant dry weight at the maximum plant growth (55 days after planting);
2. Results of stover bulbs (bulbs + leaves + roots) consist of fresh bulbs weight (at harvest), dried bulbs weight (7 days after harvest dried in the open air) and bulb weight loss according to the formula:

$$\frac{\text{fresh bulb weight - dried bulbs weight}}{\text{fresh bulbs weight}} x100\%$$

3. Uptake of N, P and K plants, count from plant dry weight x concentrations of N, P and K in the plant. The extraction method used to determine the concentration of N is Kjehdhal, for P and K use extracting Morgan Venema.
4. Pre experiment soil analysis. The data were tested by F test and DMRT at α = 5%. Meanwhile, to find out the status of N, P and K, the Liferdi & Poerwanto (2011) methodology was followed:
A. Calculate the relative yield (RY %) (mean of each repetition) as follows:

$$\text{Relative yield} = (Y_i / Y_{max}) \times 100\%$$

where:
Y_i = results in the treatment of N / P / K to-i
Y_{max} = maximum results on the status of N / P / K;
B. Furthermore, the relative yield value as the dependent variable (Y) linked to the uptake of N / P / K as independent variables (X) to be analyzed with regression models (quadratic, logistic, linear and exponential). The model has the best statistical criteria used to determine the content of N / P / K on shallot.
C. Based on the model that has been set, a line was draw to connect the nutrient uptake and RY results to determine the nutrient status (Liferdi & Poerwanto 2011). Kidder (1993) divides RY into five categories: (1) the category of extra-low (<50%), (2) low (50-75%), (3) sufficient (75-100%), (4) high (100%), and (5) very high (100%<). RY is percentage of results in the treatment by the results on the maximum condition.

Results and Discussion

Pre experiment soil analysis. The results of chemical analysis of the soil before the experiment showed that the Cirebon-alluvial soil react neutral, whereas the Brebes-alluvial soil react acid (Table 2). Alluvial soil in both locations had a low content of organic C and total N, while the content of available P and available K were very high. However, the results of chemical analysis of the soils showed that the Cirebon-alluvial soil has higher chemical fertility than Brebes-alluvial soil (Table 2).

Table 2

The chemical properties of the alluvial soils before experiment

Soil chemical properties	*Alluvial-Cirebon*	*Alluvial-Brebes*
pH (H_2O)	7.2 (neutral)	6.0 (acid)
C (%)	2.01 (low)	1.87 (low)
N (%)	0.13 (low)	0.14 (low)
C/N	15 (medium)	13 (medium)
P_2O_5-Olsen (ppm)	124.5 (very high)	76 (very high)
K_2O-Morgan (ppm)	275.1 (very high)	178.7 (very high)

Plant growth. The results of analysis of plant growth showed that there was no significant interaction between varieties and doses of N-P_2O_5-K_2O on plant height, number of tillers and plant dry weight of shallot, on both land in the Cirebon-alluvial soil and Brebes-alluvial soil. This means that the growth of Bima and Bangkok have the same response to the dose of N-P_2O5-K_2O in the both alluvial soil (Table 3).

In Cirebon-alluvial soil, Bima and Bangkok not show differences in plant height, number of tillers and plant dry weight. While, on Brebes-alluvial soil, Bangkok showed that the number of tillers and plant dry weight were significantly higher than the Bima. In Table 3 it appears that both Cirebon-alluvial soil and Brebes-alluvial soil, with different dose of fertilizes N (85-255 kg N/ha), P (50-150 kg P_2O_5/ha), and K (60-180 kg K_2O/ha) does not showed different effect on plant height, number of tillers and plant dry weight of onion. Similarly, it appears that without the application of P and K fertilizer (only N) did

not affect shallot growth on alluvial soil. This is because the content of P and K of alluvial soil is classified as very high (Table 2).

Table 3

Effect of varieties and fertilizer NPK on the shallot growth in alluvial soil

Treatments		*Cirebon-alluvial soil*			*Brebes-alluvial soil*		
		Plant height (cm)	*Number of tillers*	*Dry weight g/plant*	*Plant height (cm)*	*Number of tillers*	*Dry weight (g/plant)*
Varieties	a_1 = Bima	38.05[a]	5.78[a]	11.58[a]	43.90[a]	8.00[b]	17.83[b]
	a_2 = Bangkok	36.70[a]	6.92[a]	13.55[a]	44.46[a]	11.92[a]	21.17[a]
Dose of N-P_2O_5-K_2O (kg/ha)							
b_1 = 85–50–60		36.80[a]	6.35[a]	11.33[a]	43.07[a]	8.55[a]	17.50[a]
b_2 = 170–100–120		38.35[a]	6.55[a]	11.67[a]	46.48[a]	9.91[a]	21.67[a]
b_3 = 255–150–180		40.35[a]	6.00[a]	13.00[a]	45.45[a]	9.63[a]	23.00[a]
b_4 = 85–0–0		34.60[a]	6.05[a]	11.50[a]	40.38[a]	9.73[a]	16.67[a]
b_5 = 170–0–0		36.15[a]	6.55[a]	12.50[a]	43.28[a]	9.28[a]	22.33[a]
b_6 = 255–0–0		38.10[a]	6.60[a]	13.33[a]	46.40[a]	9.78[a]	17.83[a]
CV (%)		17.71	10.69	22.56	15.50	18.66	22.52

Different superscript on the same column means significant differences.

Bulbs yield. The analysis showed that there is no interaction exhibited between the varieties and doses of N-P_2O_5-K_2O on the fresh bulb yield, dry bulb weight (7 days after harvest) and loss of bulb weight. Table 4 shows that Bangkok has fresh bulb yield, dry bulb weight and weight loss higher than Bima on two locations. The differences shows in the results of dry bulb weight, but not in the result of fresh bulb yield weight and loss of bulb weight. The differences are due to genetic factors.

Table 4

Effect of varieties and NPK fertilizer on fresh bulb weight, dry bulb weight and loss of weight in alluvial soil

Treatments		*Cirebon-alluvial soil*			*Brebes-alluvial soil*		
		Fresh bulb weight (g/plant)	*Dry bulb weight (g/plant)*	*Weight loss (%)*	*Fresh bulb weight (g/plant)*	*Dry bulb weight (g/plant)*	*Weight loss (%)*
Varieties	a_1 = Bima	73.33[a]	48.63[a]	33.68[a]	119.17[a]	69.86[b]	41.98[a]
	a_2 = Bangkok	85.55[a]	51.61[a]	39.67[a]	136.39[a]	77.50[a]	42.89[a]
Dose of N-P_2O_5-K_2O (kg/ha)							
b_1 = 85–50–60		77.50[a]	50.18[a]	34.98[a]	123.33[a]	73.00[a]	40.45[a]
b_2 = 170 –100–120		84.17[a]	54.89[a]	34.72[a]	128.33[a]	75.17[a]	40.33[a]
b_3 = 255–150–180		87.50[a]	55.35[a]	36.74[a]	130.83[a]	75.92[a]	41.87[a]
b_4 = 85–0–0		64.17[a]	40.71[a]	36.35[a]	118.33[a]	68.92[a]	41.45[a]
b_5 = 170–0–0		76.67[a]	46.85[a]	38.89[a]	134.17[a]	74.25[a]	44.55[a]
b_6 = 255–0–0		86.67[a]	52.77[a]	39.08[a]	131.67[a]	74.83[a]	45.97[a]
CV (%)		15.38	17.84	12.97	7.14	7.11	14.18

Different superscript on the same column means significant differences.

Application of N, P and K fertilizer in the range doses of 85-255 kg N/ha, 50-150 kg P_2O_5/ha and (60-180) kg K_2O/ha give significantly difference on dry bulb weight and loss of bulb weight either on the Cirebon-alluvial soil and Brebes-alluvial soil. Nevertheless, the results of fresh bulb yield increase when doses of N, P and K fertilizer increase too (Table 4). Treatment without P and K fertilizer (N only) does not affect significantly the

results of fresh bulb yield, dry bulb weight and loss of weight (Table 4). This is due to the fact that both alluvial soils (in Cirebon and Brebes) content high amount of available P and K (Table 2).

Nutrient uptake. Nutrient uptake is an overview of the many nutrients that are absorbed by the plant, which is obtained by multiplying the dry weight of the nutrient concentration in the plant tissue. Plant tissue analysis results can be useful when having a positive correlation with the response of plants. If the value of plant tissue analysis is low, the plant growth or production would fell. Conversely, if the value of plant tissue analysis is high means that the plant can exhibit his maximum genetic potential (Liferdi & Poerwanto 2011).

In this study there was no significant interaction between varieties and NPK fertilizer on uptake of N, P and K by shallot plants, on both Cirebon-alluvial soil and Brebes-alluvial soil. Table 5 shows that Bangkok absorbing N, P and K more than Bima, on the two locations. The higher nutrients uptake delivered the Bangkok variety to produce plant dry weight (roots + leaves + bulb) higher than Bima (Table 3). N, P, and K concentrations of both varieties ranged between 2.03-3.15% N, 0.24-0.38% P and 1.57-2.80% K.

In Cirebon-alluvial soil, different dose of N - P_2O_5 - K_2O show significantly differences on N uptake, but not on P and K uptake (Table 5). Uptake of N, P and K is highest at dosing of 255 kg N - 0 kg P_2O_5 - 0 kg K_2O/ha. It seems that absence of P and K fertilizers did not affect the uptake of N, P and K on Cirebon-alluvial soils. This is because the content of P and K of the soil is very high (Table 2). Meanwhile, in Brebes-alluvial soil, uptake of N and K is significantly affected by the dose of N - P_2O_5 - K_2O, but not on P uptake (Table 5). In Brebes-alluvial soil, the highest of N, P and K was obtained by 255 kg N - 150 kg P_2O_5 - 180 kg K_2O/ha.

Table 5

Effect of varieties and NPK fertilizer on nutrients uptake in alluvial soil

Treatments		*Cirebon-alluvial soil*			*Brebes-alluvial soil*		
		N	*P_2O_5*	*K_2O*	*N*	*P_2O_5*	*K_2O*
		mg/plant			*mg/plant*		
Varieties	a_1 = Bima	323.7^{a}	77.1^{a}	359.8^{a}	444.3^{b}	117.8^{b}	375.0^{b}
	a_2 = Bangkok	366.1^{a}	98.9^{a}	374.0^{a}	579.0^{a}	151.7^{a}	480.7^{a}
Dose of N-P_2O_5-K_2O (kg/ha)							
b_1 = 85–50–60		292.5^{b}	77.2^{a}	319.8^{a}	420.2^{ab}	115.3^{a}	367.0^{b}
b_2 = 170–100–120		339.3^{ab}	84.5^{a}	332.8^{a}	608.8^{ab}	148.7^{a}	440.7^{ab}
b_3 = 255–150–180		368.3^{ab}	93.0^{a}	389.2^{a}	642.3^{a}	155.0^{a}	537.5^{a}
b_4 = 85–0–0		308.7^{b}	77.3^{a}	322.0^{a}	362.2^{b}	119.7^{a}	392.2^{ab}
b_5 = 170–0–0		347.3^{ab}	93.7^{a}	391.7^{a}	504.2^{ab}	138.7^{a}	424.7^{ab}
b_6 = 255–0–0		414.7^{a}	99.0^{a}	445.8^{a}	532.5^{ab}	131.2^{a}	405.2^{ab}
CV (%)		22.5	23.3	23.7	26.4	23.5	20.5

Different superscript on the same column means significant differences.

In Table 6 it showed that in the Cirebon-alluvial soil, the bulb yield and nutrient uptake of Bima varieties are lower than in the Bangkok varieties. An average of Bima bulb yield was 14.59 t/ha with absorbed nutrients of 97.3 kg N/ha, 23.3 kg P_2O_5/ha and 106.2 kg K_2O/ha. While, an average of Bangkok bulb yield was 15.48 t/ha with absorbed nutrients of 109.7 kg N/ha, 29.7 kg P_2O_5/ha and 110.8 kg K_2O/ha. Similarly, in Brebes-alluvial soil (Table 7), Bima bulb yield and nutrients uptake are lower than in Bangkok variety. An average of Bima bulb yield was 20.96 t/ha, with absorbed nutrients of 133.5 kg N/ha, 35 kg P_2O_5/ha and 112.5 kg K_2O/ha. Meanwhile, an average of Bangkok bulb yield was 167.0 kg/ha, with 45.4 kg P_2O_5/ha and 137.5 kg K_2O/ha consumption, and with an average tuber yield of 23.35 t/ha.

Table 6

Bulb yield and nutrients uptake of shallot in Cirebon-alluvial soil

Treatments	Bulb yield (t/ha)	Nutrients uptake (kg/ha)		
		N	P_2O_5	K_2O
		Bima (a_1)		
b_1 = 85–50–60	14.56	76.8	17.7	91.8
b_2 = 170–100–120	16.44	96.9	22.9	114.1
b_3 = 255–150–180	16.22	97.9	22.7	102.8
b_4 = 85–0–0	12.43	86.8	18.9	89.1
b_5 = 170–0–0	12.78	105.9	24.8	113.6
b_6 = 255–0–0	15.11	119.3	32.7	126.1
Average	14.59	97.3	233	106.2
		Bangkok (a_2)		
b_1 = 85–50–60	15.55	98.7	28.6	91.9
b_2 = 170–100–120	16.49	106.7	27.9	96.9
b_3 = 255–150–180	16.99	123.1	32.9	119.4
b_4 = 85–0–0	12.00	98.4	27.5	104.1
b_5 = 170–0–0	15.33	102.5	31.4	121.2
b_6 = 255–0–0	16.55	129.0	29.7	131.4
Average	15.48	109.7	29.7	110.8

300.000 plants/ha.

Table 7

Bulb yield and nutrients uptake of shallot in Brebes-alluvial soil

Treatments	Bulb yield	Nutrients uptake (kg/ha)		
		N	P_2O_5	K_2O
		Bima (a_1)		
b_1 = 85–50–60	21.05	120.9	28.7	101.4
b_2 = 170–100–120	21.10	149.2	39.3	111.1
b_3 = 255–150–180	22.05	158.7	42.1	119.7
b_4 = 85–0–0	19.60	95.4	30.3	113.9
b_5 = 170–0–0	21.25	136.6	36.1	120.9
b_6 = 255–0–0	20.70	140.0	35.5	107.9
Average	20.96	133.5	35.3	112.5
		Bangkok (a_2)		
b_1 = 85–50–60	22.75	131.2	40.5	118.8
b_2 = 170–100–120	23.50	186.6	47.1	153.3
b_3 = 255–150–180	24.60	216.2	53.1	172.8
b_4 = 85–0–0	21.75	121.9	41.5	121.2
b_5 = 170–0–0	23.30	166.9	47.1	133.8
b_6 = 255–0–0	24.20	179.5	43.2	125.2
Average	23.35	167.05	45.4	167.5

300.000 plants/ha.

Efficiency of nutrient uptake and NPK fertilizer of Bima is also lower than in Bangkok varieties in both locations (Table 8). Table 8 shows that in both alluvial soils (Cirebon and Brebes), average bulb yield of Bima was 17.75 t/ha with an average nutrient uptake of 115.40 kg N - 29.30 kg P_2O_5 - 109.35 kg K_2O/ha. The efficiency of N, P and K were 72.5% N, 32.5% P_2O_5 and 90% K_2O. Fertilizer requirements calculated from nutrient uptake was divided by percentage of nutrients effeciency. So, fertilizer requirements for Bima was: 115.4/0.725 = 160 kg N/ha, 29.30/0.325 = 90 kg P_2O_5/ha and 109.35/0.90 =

121 kg K_2O/ha, and for Bangkok: 138.35/0.81 = 170 kg N/ha, 37.55/0.45 = 83 kg P_2O5/ha and 124.15/0.90 = 138 kg K_2O/ha.

Table 8

Average of dry bulb yield, nutrients uptake, efficiency of nutrient uptake and efficiency of fertilizer upon shallot in alluvial soil

Parameters	*Cirebon-Alluvial*	*Brebes-Alluvial*	*Average*
		Bima (a_1)	
- Dry bulb yield (t/ha)	14.6	20.9	17.75
- N uptake (kg/ha)	97.3	133.5	115.40
- P_2O_5 uptake (kg/ha)	23.3	35.3	29.30
- K_2O uptake (kg/ha)	106.2	112.5	109.35
- Efficiency of nutrient uptake (%)			
N	41	55	48
P_2O_5	8	18	13
K_2O	17	27	22
- Efficiency of fertilizer (%)			
N	65	80	72.5
P_2O_5	24	41	32.5
K_2O	84	96	90
		Bangkok (a_2)	
- Dry bulb yield (t/ha)	15.5	23.2	19.4
- N uptake (kg/ha)	109.7	167.0	138.35
- P_2O_5 uptake (kg/ha)	29.7	45.4	37.55
- K_2O uptake (kg/ha)	110.8	137.5	124.15
- Efficiency of nutrient uptake (%)			
N	47	68	57.5
P_2O_5	10	23	16.5
K_2O	18	33	25.5
- Efficiency of fertilizer (%)			
N	70	92	81
P_2O_5	36	54	45
K_2O	82	98	90
Nutrients content before experiment			
N (kg/ha)	78	84	81
P_2O_5 (kg/ha)	249	152	200.5
K_2O (kg/ha)	550	358	454

300.000 plants/ha.

Nutrient uptake relationship with relative production. The relationship between nitrogen uptake and relative production of Bima and Bangkok were quadratic (Figure 1 & 2) with R^2 = 1. The Nitrogen status to get the optimal yield was sufficient (86.11%) for Bima and very high for Bangkok (105.65%). Previous reports in other plants showed that N concentration of plants increased with increase of applied N dose respectively (Lathwell & Evans 1951; Singandhupe & Rajput 1990).

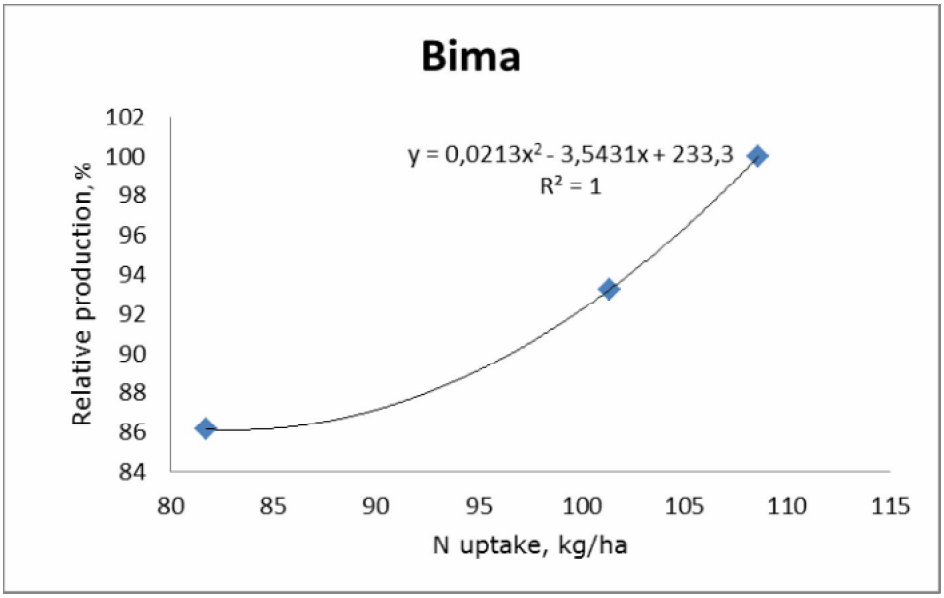

Figure 1. Correlation of N uptake with relative production of Bima.

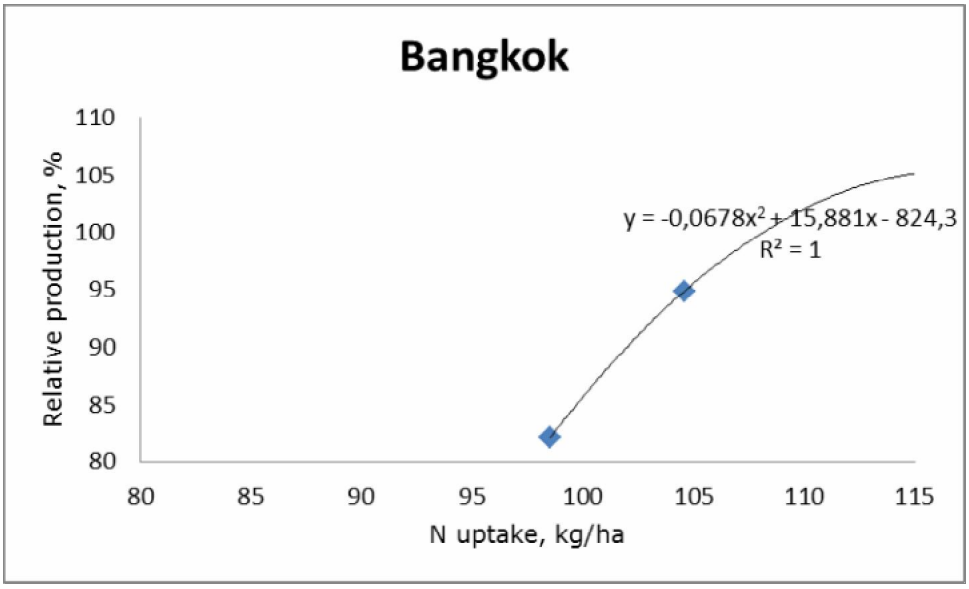

Figure 2. Correlation of N uptake with relative production of Bangkok.

The relationship between relative production and P_2O_5 uptake for Bima and Bangkok were also quadratic (Figure 3 & 4). The phosphorous status was sufficient to achieve the optimal yield (88.01%) for Bima and very high for Bangkok (105.31%).

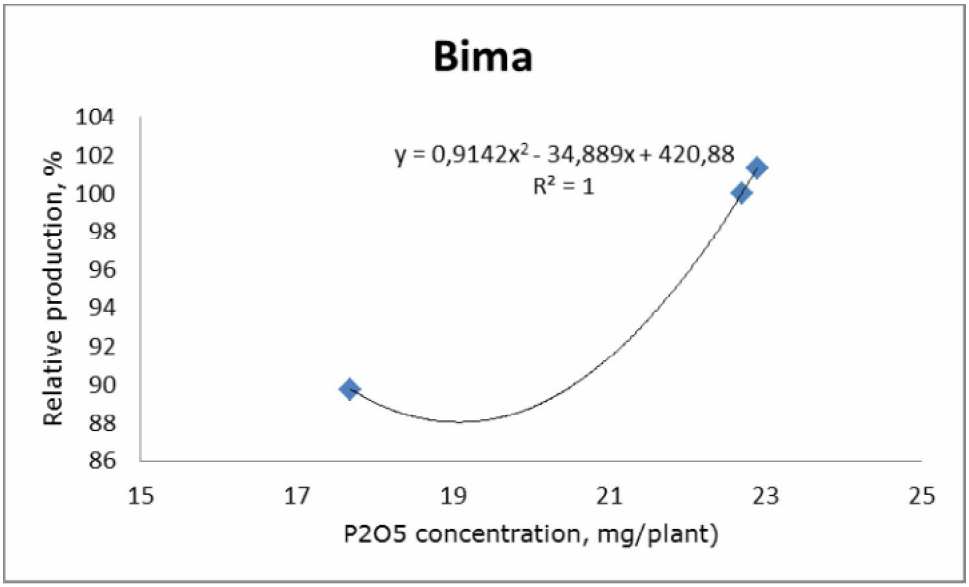

Figure 3. Correlation of P_2O_5 uptake with relative production of Bima.

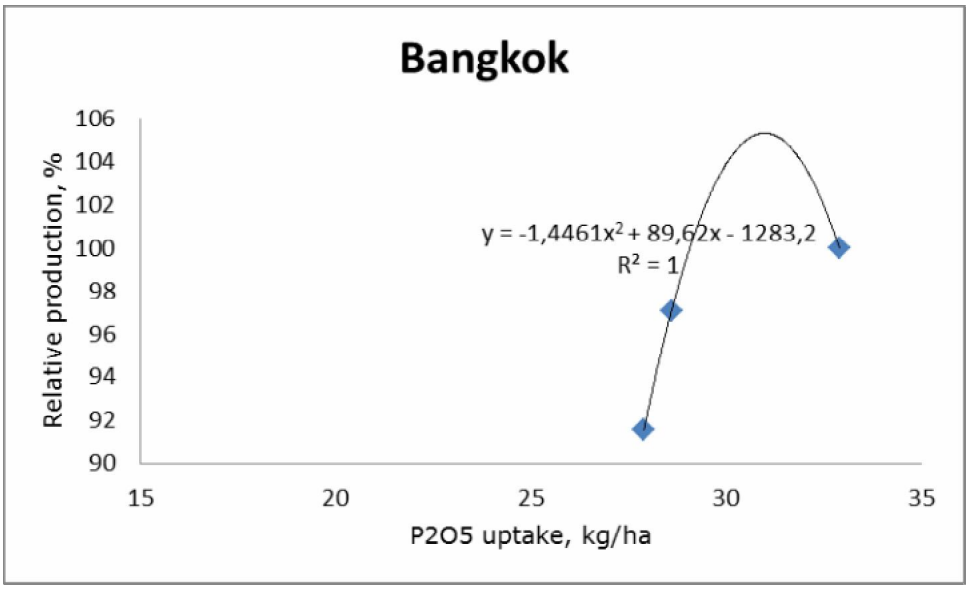

Figure 4. Correlation of P_2O_5 uptake with relative production of Bangkok.

The relationship between relative production and K_2O uptake for Bima was quadratic, while Bangkok was linear (Figure 5 & 6). The potassium status to obtain the optimal yield was very high (102.02%) for Bima, meanwhile in Bangkok variety the relative production still increased with increase of K_2O doses.

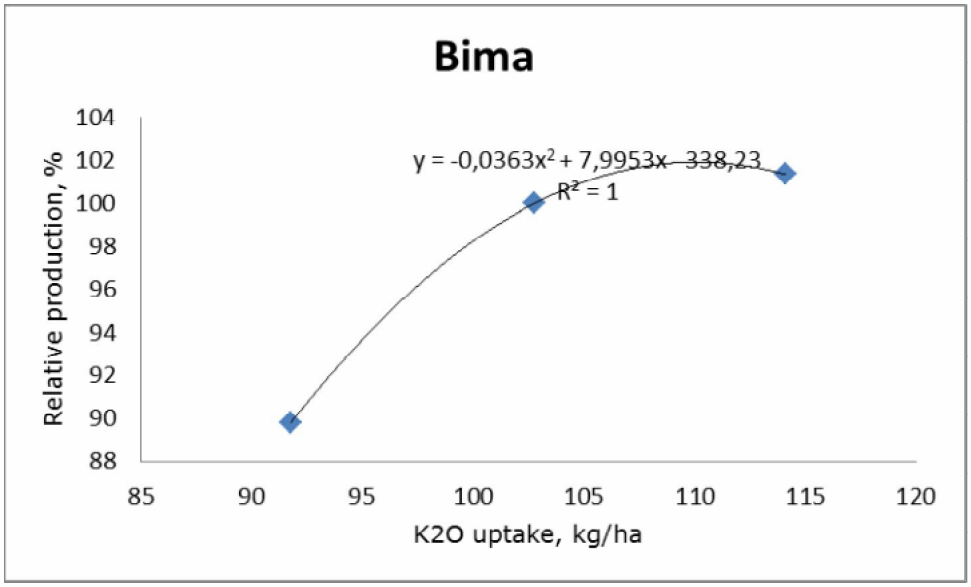

Figure 5. Correlation of K_2O uptake with relative production of Bima.

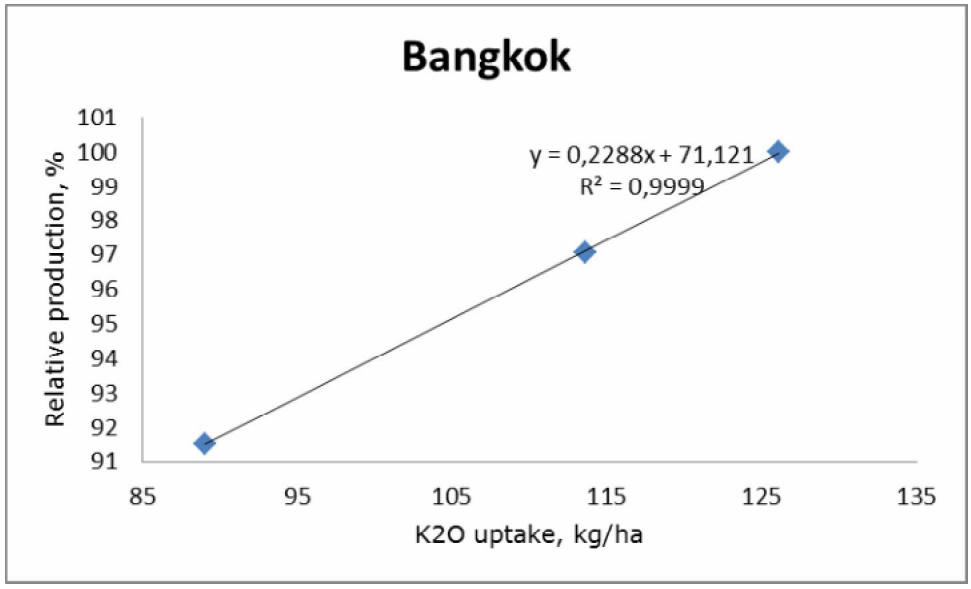

Figure 6. Correlation of K_2O uptake with relative production of Bima.

Conclusions. In alluvial soil with low N status and very high P and K status, the response of plant growth, bulb yield and nutrients uptake of shallot varieties Bima and Bangkok are relatively similar to the provision of fertilizer N, P and K. Bima showed growth of plants, bulb yield, nutrients uptake and efficiency of fertilizer lower than Bangkok variety. Application of N, P and K fertilizer in the dose range of 85-255 kg N - 0-150 kg P_2O_5 - 0-180 kg K_2O/ha showed no significantly differences on growth and yield of shallot. Fertilizer requirements for Bima was 160 kg N - 90 kg P_2O_5 - 121 kg K_2O/ha, meanwhile Bangkok was 170 kg N/ha, 83 kg P_2O5/ha and 138 kg K_2O/ha. Correlation of N, P uptake on Bima and Bangkok production were quadratic. Meanwhile, P uptake was quadratic for Bima and linier for Bangkok. The nutrient status of Bima was sufficient for N, P_2O_5 and very high for K_2O. Meanwhile the nutrient status of Bangkok was very high for N and P_2O_5.

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