

Fertigation Methods and N Source on Chili through Drip Irrigation

Metode Fertigasi dan Sumber N pada Cabai Rawit melalui Irigasi Tetes

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Received 28 September 2020/Accepted 9 November 2020

ABSTRACT

Chili (Capsicum frutescens L.) has an important role in Indonesian cuisine. Conventional crop management with less-efficient fertilizer application was still commonly implemented by farmers; on the other hand, fertilizer application through drip irrigation will increase yield and reduce production costs. Research objectives were to find out the best fertilizer application methods through drip irrigation and obtain a nitrogen fertilizer source that can increase polyethylene mulched chili yield. This research was conducted in Inceptisol (Dy tropept Fluventik, Isohiperthermik) soil type. The experiment was conducted at Bogor Agricultural University Research Station, Cikarawang, from June to December 2016. The first experiment was arranged in a randomized complete block design (RCBD) with three methods of fertilizer applications: split, drip, and conventional (no fertigation). The second experiment, from March to October 2017, was arranged in RCBD, with three N sources (Urea (46% N), ZA (21% N), and NPK (16-16-16)% N-P₂O₅-K₂O), with four replications. Results showed that split and drip fertigations had no different effect on total and marketable yield; however, the yields of both treatments were higher than that of conventional applications. The second experiment results showed that all N sources did not affect the growth and yield of chili.

Keywords: fertilization, nitrogen, micro-irrigation, polyethylene mulch

ABSTRAK

Cabai rawit (Capsicum frutescens L.) memiliki peran penting dalam menu masakan di Indonesia. Pengelolaan tanaman secara konvensional dengan pemupukan yang kurang efisien masih banyak dilakukan oleh petani, sebaliknya pemupukan secara fertigasi meningkatkan hasil dapat dan menurunkan biaya produksi. Penelitian ini bertujuan untuk mengetahui metode aplikasi pemupukan melalui irigasi dan sumber N yang dapat meningkatkan hasil cabai rawit dengan budidaya memakai mulsa plastik. Penelitian ini dilakukan pada jenis tanah Inceptisol (Dy tropept Fluventik, Isohiperthermik). Percobaan dilakukan di Kebun Penelitian Institut Pertanian Bogor, Cikarawang. Percobaan pertama pada Juni-Desember 2016 disusun dalam rancangan acak kelompok (RAK), 4 ulangan dengan 3 metode aplikasi fertigasi: split, irigasi tetes, dan konvensional (tanpa fertigasi). Percobaan kedua dilakukan pada Maret-Oktober 2017 disusun dalam RAK dengan empat ulangan dengan perlakuan tiga sumber N (Urea (46% N), ZA (21% N), dan NPK (16-16-16)% N-P₂O₅-K₂O). Hasil penelitian menunjukkan bahwa split dan drip tidak memberikan pengaruh yang berbeda terhadap total panen dan hasil panen yang dapat dipasarkan, namun keduanya lebih tinggi dari hasil panen dengan konvensional. Hasil percobaan kedua menunjukkan bahwa semua sumber N tidak berpengaruh terhadap pertumbuhan dan hasil panen cabai.

Kata kunci: irigasi mikro, nitrogen, mulsa plastik, pemupukan

INTRODUCTION

Chili is an important national commodity that needs attention because an increase in Chili prices can contribute to economic inflation. The planting areas of Indonesian

chili in 2017 was 269,806 ha, with a total production of 1,153,157 tons. The productivity of red chili is 6.37 ton ha⁻¹ and chili is 4.28 ton ha⁻¹ (BPS, 2018). This low productivity can be overcome by using advanced technology to meet the demand for Chili commodities throughout the year.

Advanced technology research has been carried out related to the development of Precision Agriculture. One

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of the precision technologies that have been developed for vegetable crops is fertigation through drip irrigation. Fertigation is the application of fertilization together with water irrigation (Chauhdary *et al.*, 2018). Through fertigation technology, the composition and rate of nutrients can be adjusted according to the physiological development of the plant, so that in addition to more efficient use of nutrients, it also affects plant growth and yield. Fertigation applications could make nutrient use more efficient by 25-40% for horticultural crops. They were compared to conventional fertilization methods, along with additional income in the range of 10-15% (Pitono, 2018). Chaudhary

Drip irrigation, also known as micro-irrigation or trickle irrigation, is a method of slowly applying water directly to the root zone. The efficiency of water use in drip irrigation is more than 90%, where the application of sprinkler irrigation is only 50 to 70%. The high efficiency of drip irrigation is caused by 1) water will wet the soil before it is lost due to evaporation or runoff; 2) application of water is only carried out in the root zone, not in the entire soil layer; 3) suppress weed growth; 4) reduce the contact of irrigation water with plant crowns so as to reduce the possibility of pest infestation (Reddy *et al.*, 2017). There was no difference in yield between fertigation via subsurface drip irrigation and through surface drip irrigation using plastic mulch (Wu *et al.*, 2019)

In fertigation, fertilizer can be applied before or at planting (preplant), or with drip irrigation, or combination between preplant with drip irrigation (split). According to rate recommendations (Mounika *et al.*, 2018), fertilizer application by fertigation to red chili plants is carried out with 100% P fertilizer at planting, N fertilization is carried out twice a week as much as 18% (2-4 MST), 14% (5-7 MST), 20% (7-8 MST), and 48% (9-20 MST), while for K fertigation along with N as much as 14% (2-4 MST), 16% (5-7 MST), 22% (7-8 MST), and 48% (9-20 MST).

Nitrogen (N) is an essential prerequisite for almost all crops and is ideal for fertigation due to its complete dissolution in irrigation water. Urea, ammonium nitrate (NH_4NO_3), calcium nitrate ($5\text{Ca}[\text{NO}_3]_2$, NH_4NO_3), potassium nitrate (KNO_3), and ammonium sulfate ($[\text{NH}_4]_2\text{SO}_4$) are some of the examples of N-containing sources. The N fertilizers are extensively used to prepare single or multi-nutrient fertilizer solutions (Fares and Abas, 2009)

Increasing the yield of paprika can be done by fertilizing it together with drip irrigation. *Nitrogen Fertilizer Use Efficiency* increases with the application of N fertilizers through drip irrigation when compared to conventional methods through furrow irrigation. The application of irrigation through drip irrigation every two days gives better results when compared to scheduling using a tensiometer (Tanaskovik, 2016). The application of fertilizers by fertigation provides yields and income when compared to the application of fertilizers by soil drench of lowland cauliflower (Sofian and Susila, 2018).

The use of polyethylene mulch or plastic mulch has been used in pepper cultivation since the early 1960s. The benefits of using polyethylene mulch are increasing yields, maintaining soil moisture, inhibiting weed growth, reducing

nutrient losses and preventing soil compaction (Bosland and Votata, 2012). Water and nutrients are two important inputs in agriculture. Efficient water and nutrient management are essential to improve productivity and maintain good quality environmental conditions. Drip irrigation is one of the most efficient and widely used irrigation methods in the world (Jat *et al.*, 2011). The use of drip irrigation combined with polyethylene mulch can increase the yield (Mehanna *et al.*, 2016). This study aims to find out the best fertilizer application methods through drip irrigation and obtain a nitrogen fertilizer source that can increase the yield of polyethylene mulched chili.

MATERIALS AND METHODS

Fertilizer Application Methods for Chili Fertigation

This study was conducted from June to December 2016 at IPB University Research Station, Cikarawang, Bogor, (-6.547928S; 106.732102E), 250 m above sea level with *Inceptisols* soil type. Soil pH 5.14, C-organic 1.43% (low), total N 0.19% ppm (low), total P 745.48 ppm (very high), and total K 212,12 ppm (very high). Four weeks of transplant age of Nirmala F1 Chili variety were used in this study. The treatments were: split application (40% N and K_2O , and 100% P_2O_5 before planting (pre-plant) and 60% of N and K_2O were applied 10% every week for six weeks through drip irrigation; drip application (100% N and K_2O were applied 16.7% every week for six weeks through drip irrigation); conventional fertilizing treatment (not using drip irrigation) as a check treatment, 100% P, 40% N and K_2O were applied as pre-plant, and 60% N and K_2O applied at 3 and 6 weeks after planting. Each treatment was arranged in RCBD with four replications so that there were 12 experimental units with a plot size of 1.5 m x 5 m with a plant spacing of 50 cm x 50 cm (*double row*). Ten samples were observed for each experimental unit. The standard fertilization rate is 300 kg N ha^{-1} from urea dose (46% N), 300 kg P_2O_5 ha^{-1} from SP-36 (36% P_2O_5), 250 kg K_2O ha^{-1} from KCl (60% K_2O) (Heryani *et al.*, 2013).

Nitrogen Fertilizer Source for Chili Fertigation

The experiment was conducted at IPB University Research Station, Cikarawang, Bogor, at an altitude of 250 m above sea level with *Inceptisols* soil type. This research was conducted from March 2017 until October 2017. Four weeks of transplant age of Nirmala F1 Chili variety were used in this study. Three N-source treatments were: N fertilizer treatment from urea fertilizer (46% N), N fertilizer treatment from ZA fertilizer (21% N), and fertilizer source treatment N derived from NPK fertilizer (16-16-16). Each treatment was arranged in RCBD with four replications so that there were 12 experimental units with a plot size of 1.5 m x 5 m with a plant spacing of 50 cm x 50 cm (*double row*). Ten samples were observed for each experimental unit. The standard fertilization rate was 300 kg N ha^{-1} from urea dose (46% N), 300 kg P_2O_5 ha^{-1} from SP-36 (36% P_2O_5), 250 kg K_2O ha^{-1} from KCl (60% K_2O) (Heryani *et*

al., 2013). Fertilization is done by split application method, 40% applied at preplant and 60% after transplanting through fertigation. Sixty percentage of the total fertilizer rate applied 6% per week for ten weeks. Standard fertilization rate were 237.07 kg N ha⁻¹, 108.33 kg P₂O₅ ha⁻¹, and 188.4 kg K₂O ha⁻¹ (Alviana and Susila, 2009).

Drip Irrigation System for Fertigation

The irrigation system equipment used is as follows 1. *The Head Unit* consists of a 1,000 liter water tank, a 350-watt electric pump, a 3/4 inch disk filter, a 3/4 inch screen filter, a water meter, 3/4 inch *Fertilizer Injector*; 2. *The Infield Unit* consists one inch PVC pipe as the *mainline*, 16 mm PE as *Sub main and Lateral*, and a *drip tape* with an emitter distance of 50 cm and a flow rate of one l hour⁻¹. Irrigation water application volume was applied to 2 liters per plant/day. Fertigation was applied to 60% N and P fertilizer, 10% for six weeks at the First experiment dan 6% for ten weeks in the second experiment. Fertilizer application for fertigation was presented in Table 1.

Crop Management

Nirmala F1 chili variety was shown in the seedling tray with planting media in the form of a mixture of sand, compost, and charcoal husk (1:1:1). Transplanting was done at six weeks after seedling. Cow manure was applied to 20 tons ha⁻¹, together with a preplant fertilizer application on the bed. *Dripnet* line was installed in the middle of the bed, then covered by polyethylene mulched. Irrigation was applied at ± 1.5 liters per plant per day. Plant pest and disease control were done when the plant begins to experience symptoms of insect attack and disease by spraying pesticide with the active ingredient of *deltamethrin* 25 g L⁻¹ for aphid (*Myzus persicae*) pests, grasshoppers (*Valanga sp.*) and thrips (*Thrips parvisipinus*), bactericidal streptomycin 2% sulfate for anthracnose disease, and fusarium wilt disease and *Phytophthora capsici* foliar sprayed with chlorpyrifos 200 g L⁻¹. Harvesting was done when the plant has reached the fully ripe fruit. The ripe fruit is characterized by bright red fruit up to 80% of the fruit. Harvesting was done at intervals every 5-7 days.

Table 1. Fertilizer application for the first and second experiments

The first experiment (g per 7.5 m ²)					The second experiment (g per 7.5 m ²)						
Treatments	%	Urea	SP36	KCL	Treatment	%	Urea	ZA	NPK	SP36	KCL
Split (preplant+drip) fertigation					Split (preplant+drip) fertigation						
a. Pre-plant	40	196	625	150	Pre-plant	40	155	339	474	225	155
b. Drip					Drip						
Week-1	10	49	0	38	Week-1	6	23	51	71	0	17
Week-2	10	49	0	38	Week-2	6	23	51	71	0	17
Week-3	10	49	0	38	Week-3	6	23	51	71	0	17
Week-4	10	49	0	38	Week-4	6	23	51	71	0	17
Week-5	10	49	0	38	Week-5	6	23	51	71	0	17
Week-6	10	49	0	38	Week-6	6	23	51	71	0	17
Drip fertigation					Week-7	6	23	51	71	0	17
Week-1	16.7	82	0	63	Week-8	6	23	51	71	0	17
Week-2	16.7	82	0	63	Week-9	6	23	51	71	0	17
Week-3	16.7	82	0	63	Week-10	6	23	51	71	0	17
Week-4	16.7	82	0	63							
Week-5	16.7	82	0	63							
Week-6	16.7	82	0	63							
Conventional (preplant+soil drench)											
Pre-plant											
a. Pre-plant	40	196	625	260							
b. Soil drench											
Week-3	30	147	0	113							
Week-6	30	147	0	113							
Rate kg ha ⁻¹ *)	100	652	833	500		100	515	1129	1580	300	376

Note: Split = 100% P₂O₅ + 40% K₂O + 40% N (preplant) & 60% K₂O + 60% N (drip). Drip = 100% P₂O₅ (preplant) & 100% N and K₂O (drip). Conventional = 100% P₂O₅ + 40% K₂O + 40% N (preplant) & 60% K₂O + 60% N (Soil Drench), *) = Fertilizer rate per hectare based on Alviana and Susila (2009)

Observation and Data Analysis

Observations were made on plant height, 50% anthesis, 50% fruit maturity, fruit weight per bed (7.5 m²), and yield prediction per ha. The observation was conducted in 10 randomly selected sample plants in each replication from one to ten weeks for plant height (cm). Observations variables of generative phase plants include: age of flowering (50% anthesis) and time of ripe fruit (50% fruit maturity) in days. The crop yield components observed include fruit weight and grade per bed, fruit weight prediction per ha. The F test analyzed the observed data at $\alpha = 5\%$. If there is a significant difference, proceed with further tests by the Duncan Multiple Range Test (DMRT) test at $\alpha = 5\%$.

RESULTS AND DISCUSSION

Plant Height

Fertilization application of all treatments did not significantly affect chili height until three weeks after transplanting. The significant effect occurred between 4 to 6 weeks after transplanting. The plant height obtained by split fertigation was not significantly different from the drip fertigation. Split and drip fertigation plant height was higher than the conventional application. From the beginning of growth until the age of 3 weeks, the plant height increase is still slow, so that the effect of treatment has not been seen. Starting with fast growth at four weeks of age, the plants' response to the treatment has occurred. Hamdani *et al.* (2019) showed that Santika F1 chili was grown on inceptisol with 40% N and K applied preplant, and 60% applied through drip irrigation (split) resulted in 12.26 ton ha⁻¹ yield from 14 ton ha⁻¹ potential yield. The source of Nitrogen fertilizer,

however, all treatment has no significant effect on chili plant height. The result of fertilizer application on plant height is presented in Table 2.

Anthesis and Maturity

Chili plants start flowering at the age of 2 weeks after planting, but some flowers dropped. The days of anthesis and days of maturity had a significant response to the three fertigation methods. Conventional fertilization resulted in later anthesis or fruit maturity time than those with split and drip fertigation. This evidence indicates that drip and split fertigation can increase nutrient absorption and utilization. So the time of the flower emergence on the conventional treatment slightly shorter than with conventional fertilization. There was no significant effect of nitrogen sources on days of anthesis and days of maturity. The impact of fertilization application on days of anthesis fruit maturity Table 3

Plant Yield

Fertigation methods significantly affect fruit weight and total yield per bed (7.5 m²) from first to the 5th harvesting. Drip fertigation resulted in a total weight of fruit per bed of 3,458.33 g for five times harvesting, and it was higher than the conventional treatment of 924.33 g. According to Hebbar *et al.* (2002), 100% water-soluble fertilizer treatment applied through drip irrigation increased yield significantly compared to other fertilization methods. However, a Nitrogen source did not significantly affect fruit weight and total fruit weight per bed for all eight harvesting times (Table 4).

The fertigation method significantly affects the total marketable yield per bed (7.5 m²) and per hectare. The split

Table 2. Effect of fertilizer application methods on chili plant height from 1 to 10 weeks after transplanting

Treatment	Plant height (cm) at 1-10 weeks after transplanting (WAT)									
	1	2	3	4	5	6	7	8	9	10
First experiment										
Split	20.81	23.82	27.60	27.79a	44.34a	55.58a	62.76a	69.88a	75.99a	78.99a
Drip	20.46	23.38	26.89	27.27a	44.00a	53.71a	61.99a	67.41a	72.18a	75.11a
Conventional	20.29	22.41	23.99	21.79b	26.71b	27.66b	34.43b	44.42b	51.61b	55.82b
Response	ns	ns	ns	*	**	**	**	**	**	**
Second experiment										
Urea	20.40	23.00	26.50	31.80	36.40	42.30	46.90	52.80	56.70	60.00
ZA	17.00	19.00	22.30	30.90	32.50	39.60	46.20	53.30	57.80	65.70
NPK	19.90	22.00	25.70	27.60	35.80	42.80	47.40	54.40	59.70	65.20
Response	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns

Note: Split = 100% P₂O₅ + 40% K₂O + 40% N (preplant) & 60% K₂O + 60% N (drip). Drip = 100% P₂O₅ (preplant) & 100% N and K₂O₅ (drip). Conventional = 100% P₂O₅ + 40% K₂O + 40% N (preplant) & 60% K₂O + 60% N (soil drench). *The values followed by the same letters within the same column are not significantly different at the 5% level of DMRT; ns = not significant; *P < 0.05; **P < 0.01

Table 3. Effect of fertilizer application methods on chili days of anthesis and fruit maturity

Treatments	50% anthesis (days)	50% fruit maturity (days)
First experiment		
Split	30.00b	81.50b
Drip	30.75b	81.50b
Conventional	42.5a	88.75a
Response	**	**
Second experiment		
Urea	31.50	75.25
ZA	31.50	77.00
NPK	29.75	75.25
Response	ns	ns

Note: Split = 100% P₂O₅ + 40% K₂O + 40% N (preplant) & 60% K₂O + 60% N (drip). Drip = 100% P₂O₅ (preplant) & 100% N and K₂O₅ (drip). Conventional = 100% P₂O₅ + 40% K₂O + 40% N (preplant) & 60% K₂O + 60% N (soil drench). *The values followed by the same letters within the same column are not significantly different at the 5% level of DMRT; ns = not significant; *P < 0.05; **P < 0.01

application did not significantly different from drip fertigation on marketable yield per bed or per hectare; however, both yields were higher than those with conventional fertilization. In the split treatment, 40% N and K were given before planting; meanwhile, all N and K were through fertigation in the Drip treatment. In split, the plants obtained N and K nutrients as growth starters, but this condition did not affect the yield per plot of chili. Split and drip resulted in a higher fruit weight than conventional. The amount of irrigation water in the conventional method is likely lower than the other two treatments. In conventional methods, fertilizers are applied three times during the growing season. Locascio *et al.* (1989) showed that the yield of tomato was greater with 60% drip used N and K (split fertigation) than with

preplant used N and K (100% broadcast before planting). The total marketable yield per bed or hectare was not affected by Nitrogen sources (Table 5 and 6).

The productivities of Nirmala F1 chili variety in this study were 3.46 ton ha⁻¹ (first experiment), and 2.46 ton ha⁻¹. (second experiment), both productivities were lower than national productivity (4.28 ton ha⁻¹). Some contributing factors include 1. The soil analysis results showed that the total soil P content was 745.48 ppm (very high), and the total K content was 212,12 ppm (very high). At the same time, the fertilization recommendations in this experiment were not determine based on soil analysis. Fertilization rate recommendations were taken from Heryani *et al.* (2013) and Alviana and Susila (2009); 2. Another factor is the possible

Table 4. Effect of fertilizer application methods on chili fruit weight per bed (7.5 m²)

Treatments	Fruit weight per bed (g per 7.5 m ²)								
	Harvest 1	Harvest 2	Harvest 3	Harvest 4	Harvest 5	Harvest 6	Harvest 7	Harvest 8	Total
First experiment									
Split	328.69a	514.50a	795.50a	611.25a	1058.50a	-	-	-	3,308.44a
Drip	317.90a	561.69a	716.00a	753.25a	1109.50a	-	-	-	3,458.33a
Conventional	44.50b	76.67b	111.36b	151.30b	540.50b				924.33b
Response	**	**	**	**	*	-	-	-	**
Second experiment									
Urea	213.89	230.70	58.35	103.32	334.76	721.20a	495.20	198.51	2,355.80
ZA	228.07	255.60	119.01	137.08	502.09	815.40	575.30	262.96	2,895.50
NPK	198.63	237.70	110.40	110.18	391.26	909.90	495.20	319.42	2,878.90
Response	ns	ns	ns	ns	ns	ns	ns	ns	ns

Note: Split = 100% P₂O₅ + 40% K₂O + 40% N (preplant) & 60% K₂O + 60% N (drip). Drip = 100% P₂O₅ (preplant) & 100% N and K₂O₅ (drip). Conventional = 100% P₂O₅ + 40% K₂O + 40% N (preplant) & 60% K₂O + 60% N (soil drench). *The values followed by the same letters within the same column are not significantly different at the 5% level of DMRT; ns = not significant; *P < 0.05; **P < 0.01

lack of volume of watering. The low watering impact can be seen from the lower yields in the conventional method where the fertilizer is soil drench three times only, however ten times for drip and split fertigation. For further research, fertilizer recommendations base on soil analysis was needed.

Meanwhile, in the second experiment, the nitrogen source had no significant effect. NPK contains additional P and K, but the P and K content available, the land is very

high, so the plants do not give a response. The second experiment was carried out during the dry season. It was seen that the irrigation volume had a significant impact on productivity. For drip irrigation applications, it is necessary to carry out an in-depth study of chili plants' daily water requirements according to the plant growth phase. Labor cost analysis also needs to be evaluated for future adoption of fertigation technology for vegetable crop management.

Table 5. Effect of fertilizer application methods on chili total fruit weight grade 1, 2, 3, 4, and marketable weight per bed (7.5 m²)

Treatment	Fruit weight per bed (g per 7.5 m ²)				Marketable yield (1+2+3)
	Grade 1	Grade 2	Grade 3	Grade 4	
First experiment					
Split	160.10a	271.73a	183.25a	24.37	615.08a
Drip	145.71a	290.02a	216.11a	37.63	651.85a
Conventional	58.44b	75.50b	53.21b	16.43	185.64b
Response	**	**	**	ns	**
Second experiment					
Urea	202.10	1,167.70	782.80	172.25	2,152.60
ZA	326.60	1,504.90	842.40	192.15	2,673.80
NPK	330.50	1,456.30	851.70	205.43	2,638.40
Response	ns	ns	ns	ns	ns

Note: Split = 100% P₂O₅ + 40% K₂O + 40% N (preplant) & 60% K₂O + 60% N (drip). Drip = 100% P₂O₅ (preplant) & 100% N and K₂O (drip). Conventional = 100% P₂O₅ + 40% K₂O + 40% N (preplant) & 60% K₂O + 60% N (soil drench). *The values followed by the same letters within the same column are not significantly different at the 5% level of DMRT; ns = not significant; *P < 0.05; **P < 0.01

Table 6. Effect of fertilizer application methods on chili total weight (ton ha⁻¹)

Treatments	Fruit weight ton ha ⁻¹					Total (1-4)			
	Grade 1	Grade 2	Grade 3	Grade 4	Total (1-4)				
First experiment									
Split	0.33a	0.51a	0.80a	1.06a		3.31a			
Drip	0.32a	0.56a	0.72a	1.11a		3.46a			
Conventional	0.04b	0.07b	0.11b	0.54b		0.92b			
Response	**	**	**	*		**			
Second experiment									
	Harvest 1	Harvest 2	Harvest 3	Harvest 4	Harvest 5	Harvest 6	Harvest 7	Harvest 8	Total (1-8)
Urea	0.18	0.20	0.05	0.09	0.28	0.61	0.42	0.17	2.00
ZA	0.19	0.22	0.10	0.12	0.42	0.69	0.49	0.23	2.46
NPK	0.17	0.20	0.10	0.09	0.33	0.77	0.51	0.27	2.44
Response	ns	ns	ns	ns	ns	ns	ns	ns	ns

Note: Split = 100% P₂O₅ + 40% K₂O + 40% N (preplant) & 60% K₂O + 60% N (drip). Drip = 100% P₂O₅ (preplant) & 100% N and K₂O (drip). Conventional = 100% P₂O₅ + 40% K₂O + 40% N (preplant) & 60% K₂O + 60% N (soil drench). *The values followed by the same letters within the same column are not significantly different at the 5% level of DMRT; ns = not significant; *P < 0.05; **P < 0.01

CONCLUSIONS

Split (40% preplant + 60% drip) and drip (100% drip) of Nitrogen and Potassium fertilizer application through drip irrigation resulted in significantly higher plant height and yield than conventional (33% three times soil drench) fertilization. There is no difference between the response of plant chili growth and the yield on urea (45% N), ZA (21% N), and NPK(15-15-15%, N-P₂O₅, K₂O) as a fertilizer sources for fertigation.

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