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Effect of fertigation and mulching on growth, yield and yield attributing characteristics of pointed gourd (*Trichosanthes dioica* Roxb.) cv. Swarna Alaukik

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Abstract

Pointed gourd (*Trichosanthes dioica* Roxb.) is an important remunerative perennial cucurbitaceous vegetable crop of Odisha and is known as the king of gourds. Fertigation practices with and without mulching has not been standardized for pointed gourd cv. Swarna Alaukik. Hence, a field experiment was conducted to study the effect of fertigation and mulching on growth, yield and yield attributing characteristics of pointed gourd cultivation in a sandy loam textured acidic soil with low organic carbon, available nitrogen and available potassium content of Odisha. It is seen that application of different graded dose of N, P and K through fertigation in association with mulching increased the pointed gourd fruit yield per hectare. The results revealed that the maximum values for the growth traits such as vine length (395.7 cm), number of leaves per plant (208.6) and leaf area (29.68 cm²) and yield and yield attributing characters such as number of female flowers (124.6), number of fruits per plant (93.90) and fruit yield (151.4 q/ha) were recorded with the application of 100 percent N, P and K (RDF) through fertigation and mulching which remained at par with treatment where 80 percent N, P and K is applied through fertigation and mulching. Thus, 80% fertigation with mulch was the most effective treatment with 20% fertiliser saving and 55.3% increase in yield compared to the control. The highest yield of these treatments were the sum total effect of different growth and yield attributing characters particularly vine length, number of leaves per plant, leaf area, number of female flowers, number of fruits per plant etc. The fruit yield increased significantly due to maximum utilization of nitrogen, phosphorus and potassium that resulted in increased vegetative growth, reflecting in turn better foliage production, increase in the vine length, yield attributing characters and finally yield.

Keywords: pointed gourd, fertigation, mulching, growth, yield

Introduction

Pointed gourd (*Trichosanthes dioica* Roxb.) is a tropical vegetable crop, commonly called as 'Parval'. It is a perennial cucurbit belonging to family cucurbitaceae. It is known as the king of gourds because of very high nutrient content as compared to other cucurbits. Protein, mineral, fibre and calcium content of pointed gourd leaves is the highest (5.4 g, 3.0 g, 4.2 g and 531 mg per 100 g of edible portion, respectively) among all the cucurbits, and it also provides high energy of about 55 kilocalories.

"Swarna Alaukik" an open pollinated variety of pointed gourd responds well to fertilizers and is a high yielding variety developed by ICAR Research Complex for Eastern Region Research Centre, Ranchi, Jharkhand having light green fruits with blunt ends. Fruits are 5-8 cm long, solid having thin skin. This can be cooked as a curry and can also be used for preparation of sweets. This vegetatively propagated, perennial, dioecious cucurbit is an extremely nutritive, wholesome and highly accepted vegetable which is available for eight months of the year (February to September). It is cultivated in spring-summer and rainy season in Odisha's weather condition but gives higher yield in spring-summer season. As most of the fruiting season falls under water scarcity period i.e. spring-summer so proper care should be taken during summer months towards judicious irrigation, fertilizer application and mulching.

Fertigation - a modern agro-technique associated with drip irrigation provides an excellent opportunity to maximize yield and minimize environmental pollution (Hagin *et al.*, 2002)^[5] by increasing fertilizer use efficiency, minimizing fertilizer application and increasing return on the fertilizer invested.

In fertigation over all nutrient use efficiency could be as high as 90 per cent compared to 40 to 60 per cent in conventional methods (Solaimalai *et al.*, 2005) ^[16]. Use of mulch has also been proved effective in minimizing water loss through evapotranspiration and plays an important role in the production of vegetable crops especially pointed gourd because they help in conservation of soil moisture, soil temperature, weed suppression, improving soil fertility and structure of soil which are ultimately helpful in boosting up the production. used to warm the soil, conserve the moisture.

Materials and Methods

The field experiment was carried out during 2016-17 at the experimental field of Precision Farming Development Centre, Horticulture Research Station (HRS), Orissa University of Agriculture and Technology (OUAT), Bhubaneswar in pointed gourd cv. Swarna Alaukik. The recommended dose of pointed gourd was 150:60:80 kg N:P:K/ha. The experiment was conducted with eight treatments including control. Different treatments were taken including fertigation with recommended dose of fertilizer and mulching.

Details of Treatments

T₁: Fertigation with 100% RDF

T₂: Fertigation with 80% RDF

T₃: Fertigation with 60% RDF

T₄: Fertigation with 100% RDF + mulching

T₅: Fertigation with 80% RDF + mulching

T₆: Fertigation with 60% RDF + mulching

T₇: Drip irrigation + RDF in soil application

T₈: Irrigation in furrow without mulching + RDF in soil application

The experiment was laid out as per Randomized Complete Block Design (R.C.B.D.) consisting of eight treatments with three replications. The experimental area was divided into 24 plots of 5 m × 4 m and each plot consisted of 25 plants planted at a spacing of 1.2 m × 1 m. The individual plots were incorporated with organic manures such as FYM @ 5 t/ha 15 days before transplanting and were allowed for decomposition. After incorporation of organic manures, the plots were levelled properly. The plots were planted with rooted cuttings of pointed gourd both male and female plants in 1:10 ratio at a spacing of 1.2m x 1m accommodating 25 plants per plot. Light irrigation was given by rose cane after planting for easy establishment. Subsequent irrigation was continued through drip irrigation throughout the cropping period. The recommended fertilizer dose of 150:60:80 kg/ha with respect to N, P₂O₅ and K₂O were applied in split doses during the entire cropping period. N, P₂O₅ and K₂O were applied through Urea (46:0:0), IFFCO (18:18:18) and SOP (0:0:50) with drip irrigation at one month interval throughout the cropping period.

Adequate plant protection measures were taken by spraying Triazophos 40 EC @ 2 ml per litre as and when required to raise the crop successfully. Pointed gourd fruits were harvested periodically after attaining the marketable maturity

stage. Harvesting of fruits started after 95 days of transplanting which continued for about eight months. Biometric observations *viz.*, growth parameters (vine length, number of leaves per plant, leaf area), yield and yield attributing parameters (number of female flowers, number of fruits per plant, and fruit yield) were recorded. The collected data were subjected to statistical analysis as per Sukhatme and Amble (1995) ^[17].

Results and Discussion

Growth attributing characters

The results of the present studies revealed that the growth parameters of pointed gourd like vine length, number of leaves per plant, leaf area were significantly influenced by fertigation and mulching. The maximum vine length (395.7 cm), number of leaves per plant (208.6) and leaf area (29.68 cm²) were noticed by application of 100 percent RDF through fertigation under mulched condition (T₄) which was at par with the treatment of fertigation with 80% RDF + mulching (Table 1). However, they individually differ significantly over control. All these parameters were found minimum in the control plots where irrigation was applied in furrows without mulching + RDF in soil application. Fertigation with recommended dose of fertilizer might have attributed to sustain the supply of required nutrients during the growth period. Also it is observed that nitrogen being an important constituent of chlorophyll, enzymes and proteins has a definite role in increasing the cell size and cell division resulting faster growth to produce long vines, having more number of leaves as well as leaf area. Phosphorus being an important nutrient for root development is required for better utilization of increased nitrogen dose (Marschner, 1995) ^[8] and its supply at early stage of plant growth increases the photosynthetic efficiency (Tisdale and Nelson, 1984) ^[18], thus, resulted an increase in growth parameters like number of leaves and leaf area. Potassium plays an important role in improving the photosynthetic activity and translocation of carbohydrates for the development of arial parts (Nair *et al.*, 1996) ^[9]. Thus, application of balanced dose of nitrogen, phosphorus and potassium improved the vine length to a greater extent in the trial. This increase in vine length in the drip irrigation trial could be due to increased fertilizer and water use efficiency owing to better availability of moisture and nutrients. It is observed that plastic mulches directly affect micro climate around plant by modifying radiation budget (absorbing vs reflectivity) of the surface and decreasing the soil water and nutrient loss (Rani *et al.*, 2012) ^[11]. Number of primary branches per plant ranged from 5.9 to 7.53 (Table 1). No significant difference was observed among treatments with respect to number of primary branches. Similar results with respect to growth parameters were also found by Singandhupe *et al.* (2006) ^[15] and Ram *et al.* (2013) ^[10] in pointed gourd, Gupta *et al.* (2014) ^[4], Aniekwe and Anike (2015) ^[2] and Sikarwar and Hardaha (2016) ^[14] in cucumber, Ferus *et al.* (2011) ^[3] in watermelon, Alenazi *et al.* (2015) ^[1] in muskmelon.

Table 1: Effect of graded doses of fertigation and mulching on vine length, number of leaves per plant, number of primary branches per plant, leaf area, number of female flowers, number of fruits per plant and fruit yield of pointed gourd.

Treatment	Vine length (cm)	Number of leaves	Number of primary branches	Leaf area (cm ²)	Number of female flowers	Number of fruits	Fruit yield (q/ha)	
T ₁	Fertigation with 100% RDF	386.1	203.73	7.47	27.47	110.7	83.47	133.87
T ₂	Fertigation with 80% RDF	360.4	198.1	7.33	23.01	100.2	82.27	130.83
T ₃	Fertigation with 60% RDF	305.9	191.47	6.53	20.07	93.1	71.53	123.22
T ₄	Fertigation with 100% RDF +	395.7	208.6	7.53	29.68	124.6	93.90	151.54

	mulching							
T ₅	Fertigation with 80% RDF + mulching	379.2	200.27	7.4	24.84	118.4	89.30	148.3
T ₆	Fertigation with 60% RDF + mulching	318.5	194.53	6.93	21.46	95.8	77.90	129.2
T ₇	Drip irrigation + RDF in soil application	252.3	180.47	6.3	18.06	90.4	70.40	116.42
T ₈	Irrigation in furrow without mulching + RDF in soil application	205.7	154.89	5.9	15.28	64.3	48.30	95.28
	Mean	325.4	191.50	6.9	22.48	99.6	77.13	128.58
	SEm (±)	11.22	2.44	0.37	1.38	3.93	2.30	5.43
	CD _(0.05)	34.04	7.42	NS	4.20	11.94	7.00	16.47
	CV	5.97	2.21	9.40	10.67	6.83	5.18	7.31

Yield attributing parameters

As regard to number female flowers are concerned highest number of female flowers are produced by the application of N, P and K through fertigation with mulching. The treatment with 100 percent RDF through fertigation and mulching (T₄) is significantly superior than rest of the treatments including control but remained at par with treatment where 80 percent RDF is applied through fertigation and mulching. The results indicated that maximum number of female flowers (124.6) were obtained in pointed gourd by application of 100 percent RDF through fertigation under mulch condition (T₄) which was at par with the treatment of fertigation with 80% RDF + mulching (Table 1). This might be due to application of optimum and balanced dose of nitrogen, phosphorus and potassium by fertigation which helped to increase the number of female flowers to a greater extent in the trial. In the present investigation it was observed that there was an increase in the number of fruits per plant (93.9) by application of 100 percent N, P and K (RDF) through fertigation with mulching (T₄) which was also significantly higher than other treatments including control but remained at par with treatment where 80 percent RDF was applied through fertigation and mulching (Table 1). This may be due to increased allocation of photosynthates towards economic part i.e. fruit by increased fertilizer and water use efficiency owing to better availability of moisture and nutrients through fertigation and mulching. Use of mulch proved to be beneficial in improvement of number of fruits per plant than other treatments. Similar findings are obtained by Rani *et al.* (2012) [11] in pointed gourd and Shinde *et al.* (2010) [13] in cucumber.

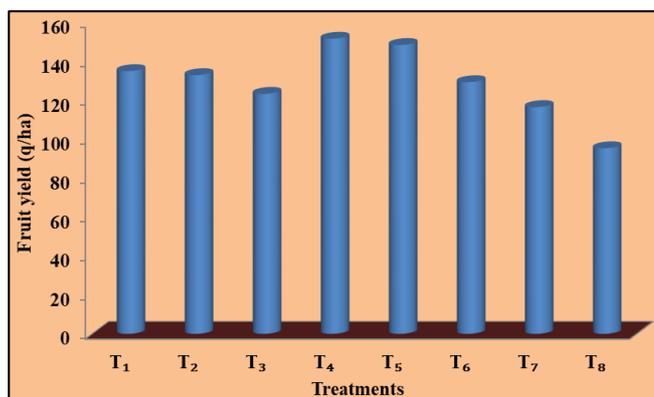


Fig 1: Effect of graded doses of fertigation and mulching on fruit yield (q/ha) of pointed gourd

Yield

Maximum yield of 151.54 q/ha was obtained with the application of 100 percent N, P and K (RDF) through fertigation and mulching (T₄) Fig.1 which was significantly higher than other treatments including control but remained at

par with application of 80 percent N, P and K (RDF) through fertigation and mulching (Table 1). This increase in yield might have been due to the better performance of yield attributes as these attributes have a positive influence on the yield. Increased yield could be largely attributed to the increase in soil temperature due to application of mulch, which resulted in improvement in soil environment around roots of pointed gourd and reduction in weed population which led to increasing plant growth and total yield increase. Rani *et al.* (2012) [11] in pointed gourd recorded highest yield of 15.78 tonnes/ha with 100% fertigation + mulch. The results of yield were in conformity with those of Rani *et al.* (2012) [11] and Ram *et al.* (2013) [10] in pointed gourd, Hari and Devi (2016) [6] and Kayande *et al.* (2016) [7] in bitter melon, Sharma *et al.* (2009) [12], Shinde *et al.* (2010) [13] and Sikarwar and Hardaha (2016) [14] in cucumber, Wang *et al.* (2011) [19] in watermelon.

It can be summed up that highest growth, yield and yield attributing characters like vine length, number of leaves per plant, number of female flowers, number of fruits per plant etc of pointed gourd could be achieved by application of 100% RDF through fertigation and mulching but it remained at par with treatments where 80% RDF was applied through fertigation and mulching.

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