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## Effect of different lateral spacing and fertigation level on yield and economics of cotton and maize

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### Abstract

This study was carried out to determine the effects of different lateral spacing and fertigation level to assess the productivity and profitability of cotton and maize crop. A field experiment was conducted at Institute of Agriculture, Kumulur during 2020- 21. Result revealed that, among the drip lateral spacing 1.20 m with 4 lph at 0.6 m spacing and application of 125% of recommend Nitrogen and potassium recorded higher yield, gross return, Net return and B: C ratio in both cotton and maize crop.

**Keywords:** Cotton, drip economics, irrigation, fertigation, maize

### Introduction

Cotton (*Gossypium hirsutum* L.) is a important commercial crop of India; it sustains the cotton textile industry which perhaps the largest segment of organized industries in the country. Maize is one of the most important cereals in India and provides food for human and animals. Cotton and maize crops are responds very well to water and nutrient and influencing the productivity crop. Fertigation is a method of fertilizer application in which fertilizer is incorporated within the irrigation water by the drip system. Drip fertigation can help to use water and fertilizer efficiently and increased yield and quality of crop. Water and Fertilizer can be applied in better time to meet plant needs, which save the water fertilizers use efficiency and the yield of crop. (Fanish *et al.*, 2011) [2]. By this method, fertilizer use efficiency is increased from 80 to 90 percent. Effects of different lateral spacing and fertigation level for cotton and maize has not been researched.

### Materials and Methods

Field experiment was conducted at Institute of Agriculture, Kumulur, Trichy. The farm is situated in Cauvery delta Agro climatic zone of Tamil Nadu. It located with 10°N longitude and 77° E latitude at an altitude of 70 m above mean sea level and the farm receives the normal total annual rainfall of 820 mm. Trial was conducted with red sandy loam type of soil and it was medium in organic carbon content and the available nutrient status was low in nitrogen, phosphorus and medium in potassium.

### Experimental design and treatments

The Field experiment field was prepared by giving two dry ploughing with disc plough followed by clod crushing to achieve fine seed bed and then Lateral was laid out and crop was sown as per the treatment. Crop variety selected for cotton (MCU 5) and Maize (CoHM 8) for sowing. The recommended dose fertilizer for cotton is 120:60:60 kg of NPK / ha and Maize is 150:75: 75 kg of NPK / ha was applied through drip fertigation with Water soluble fertilizer (Urea, Di- Ammonium, Phospahte and Muriate of Potash) respectively in various growth stages. Field experiment was laid out in split plot design with three replications consisting four lateral spacing in main plots and three fertilizer levels in sub plot. The treatments were as follows.

**Treatments**

**Main Plot**

- L<sub>1</sub>**: 0.90 m lateral spacing, 4 lph at 0.6 m spacing for cotton, Maize
- L<sub>2</sub>**: 1.20 m lateral spacing, 4 lph at 0.6 m spacing for cotton, Maize
- L<sub>3</sub>**: 1.50 m lateral spacing, 4 lph at 0.6 m spacing for cotton, Maize
- L<sub>4</sub>**: Check (Existing recommend plant spacing for cotton (90 cm × 60) and Maize (60 cm × 30))

**Sub Plot**

- F<sub>1</sub>**: 75% of recommend N & K
- F<sub>2</sub>**: 100% of recommend N & K
- F<sub>3</sub>**: 125% of recommend N & K

**Results and Discussion**

**Effect of lateral Spacing & fertigation levels on seed cotton and maize yield**

**Cotton**

Seed cotton yield was significantly influenced by lateral spacing & fertigation levels. Whereas interaction effect showed non- significant with respect to lateral spacing in cotton and maize. Higher seed cotton yield (1847 Kg/ha) was recorded in lateral spacing of 1.20 m with 4 lph at 0.6 m spacing (L<sub>2</sub>) and it was followed by lateral spacing of 1.50 m with 4 lph at 0.6 (L<sub>3</sub>). Lower seed cotton yield (1322 kg /ha) was recorded with existing recommend plant spacing for cotton (L<sub>4</sub>). Among the fertigation levels significantly higher seed cotton yield of 1646 Kg/ha (Table 1) was noticed in 125% of recommended dose of N& K (F<sub>3</sub>). This was statistically on par with F<sub>2</sub> (100% of recommended doses of N &K) which recorded seed cotton yield (1528 Kg/ha.) Whereas lower seed cotton yield (1623 Kg/ ha) was recorded with 75% of /recommended dose of N & K (F<sub>1</sub>). The increased level of fertilizer from 75 to 125% RDF might have

increased the vegetative growth, photosynthetic rate, accumulation and translocation of metabolites from source to sink which directly expressed in the form of increased seed cotton yield. In drip fertigation, seed cotton yield increased linearly with increased doses of fertilizer. Nalayani *et al.*, (2012) and Kakade *et al.*, (2017) <sup>[3]</sup> have reported similar findings that fertigation with 125% recommended dose of N and K increased yield attributes than other lower levels and soil application of fertilizers. This was in conformity with the findings of Anusree *et al.* (2020) <sup>[5]</sup> drip fertigation with water soluble fertilizers were utilized more efficiently by cotton plants than normal straight fertilizers.

**Maize**

Among the lateral spacing of 1.20m lateral Spacing (L<sub>2</sub>) recorded significantly higher maize grain yield (6675 Kg/ha). This was statistically on par with lateral spacing of 1.50 m with 4 lph at 0.6 (L<sub>3</sub>) 6397 Kg/ha. Lower maize grain yield (5786 kg/ha) was recorded in existing recommend plant spacing for cotton (L<sub>4</sub>). In fertigation levels, 100% of recommended dose of N& K (F<sub>2</sub>) recorded higher maize grain yield (6440Kg/ha). This was statistically on par with 125% of recommended dose of N & K (F<sub>3</sub>). Whereas lower maize grain yield (5973 Kg/ha) was recorded in 75% of recommended dose of N & K (F<sub>1</sub>). The increase in cotton and maize yield with drip fertigation of 125% of recommended dose of N& K. it was mainly due to greater and consistent availability of soil moisture and nutrients resulting better crop growth development, yield parameters which enhance the yield of crops. The effect of water soluble fertilizer on seed cotton yield might be due to higher amount of nutrients derived from fertilizer applied and efficient nutrient uptake of crops. Similar results were expressed by Velmurugan *et al.*, (2014) <sup>[6]</sup> in cotton, Bhakare *et al.*, (2015) <sup>[1]</sup> in cotton and Fanish and Muthukrishnan (2011) <sup>[2]</sup> in maize

**Table 1:** Effect of lateral Spacing & fertigation levels on yield of cotton and maize (Kg/ha)

Treatment	Seed cotton yield (Kg/ha)				Maize grain yield (Kg/ha)			
	F1	F2	F3	Mean	F1	F2	F3	Mean
L1	1398	1523	1600	1507	6034	6230	6250	6172
L2	1789	1907	1847	1847	6392	6994	6639	6675
L3	1675	1760	1725	1720	6135	6547	6510	6397
L4	1250	1300	1414	1322	5331	5987	6042	5786
Mean	1528	1623	1646		5973	6440	6360	
	L	F	L x F	F x L	L	F	L x F	F x L
SEd	29	24	49	49	179	148	301	296
CD(P:0.05)	72	52	Ns	Ns	440	313	NS	NS

**Effect of lateral spacing & fertigation levels on economics of cotton**

**Cotton:** Higher gross return (Rs. 152,533/ha), Net return (Rs. 76,276) and B: C Ratio (2.0) was recorded when Lateral spacing of 1.20 m with 4 lph at 0.6 m along with application of 125% recommended N & K (L<sub>2</sub> F<sub>2</sub>) (Table 2.) and it was followed by 1.50 m lateral spacing, 4 lph at 0.6 m spacing along with Application of 125% recommended N & K (L<sub>2</sub> F<sub>3</sub>). Check plot along with 25% recommended N & K recorded lower gross return, Net return and B: C Ratio.

**Maize**

Lateral spacing of 1.20 m with 4 lph at 0.6 m along with application of 125% recommended N & K (L<sub>2</sub> F<sub>2</sub>) recorded higher gross return (Rs.174,850 /ha), Net return (Rs.103,085) and B: C Ratio (2.44) in cotton (Table 1.) and it was followed by 1.50 m lateral spacing, 4 lph at 0.6 m spacing along with Application of 125% recommended N & K (L<sub>2</sub> F<sub>3</sub>). Check plot along with 25% recommended N & K recorded lower gross return, Net return and B: C Ratio.

**Table 2:** Effect of lateral spacing & fertigation levels on economics of cotton

Treatments	Cotton				Maize			
	Seed cotton Yield (Kg/ha)	Gross Return (Rs.)	Net Return (Rs.)	BCR.	Seed cotton Yield (Kg/ha)	Gross Return (Rs.)	Net Return (Rs.)	BCR
L1F1	1398	111840	32364	1.41	6034	150850	78372	2.08
L1F2	1523	121867	39899	1.49	6230	155758	78282	2.01
L2F1	1600	128000	43540	1.52	6250	156258	73784	1.89
L2F2	1789	143093	69328	1.94	6392	159792	93025	2.39
L2F3	1907	152533	76276	2.00	6994	174850	103085	2.44
L3F1	1847	147733	68984	1.88	6639	165983	89220	2.16
L3F2	1675	134027	63690	1.91	6135	153375	90036	2.42
L3F3	1760	140800	67971	1.93	6547	163675	95338	2.40
L4F1	1250	100027	14840	1.17	5331	133267	49368	1.59
L4F2	1300	104000	16321	1.19	5987	149667	60770	1.68
L4F3	1414	113147	22976	1.25	6042	151050	57155	1.61

**Effect of lateral spacing & fertigation levels on Post-harvest soil available NPK (kg/ha)**

**Cotton**

**Available Nitrogen**

Higher available nitrogen was recorded 1.50 m lateral spacing, 4 lph at 0.6 m spacing (L3) and it was on par with 1.20 m lateral spacing, 4 lph at 0.6 m spacing (L2). Control plot recorded in lower available nitrogen. Application of 125% of recommend N & K recorded higher available nitrogen (Fig. 1 & Fig. 2.) and it was followed by application 100% of recommend N & K. Available Nitrogen was lower in control plot. There was no significant interaction on available nitrogen due different lateral spacing and fertilizer level in both cotton and maize.

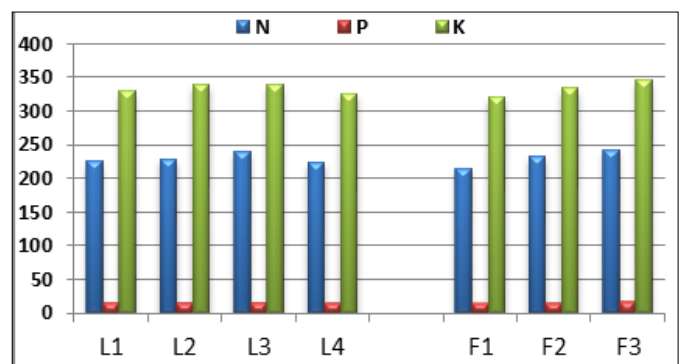
**Phosphorous**

When 1.50m lateral spacing, 4 lph at 0.6 m spacing (L3) recorded higher available phosphorous (Fig. 1 & Fig. 2.) and it was on par each other with 1.20 m lateral spacing, 4 lph at 0.6 m spacing (L2) and 0.90 m lateral spacing, 4 lph at 0.6 m spacing for cotton. Lower Available Phosphorous was registered in control plot. Higher available phosphorous recorded in Application of 125% of recommend N & K (F3) and It was followed by Application of 100% of recommend N & K (F2). Control plot recorded lower available phosphorous. Different geometries on lateral and fertilizer level did not have any significant influence on available phosphorous in both cotton and maize.

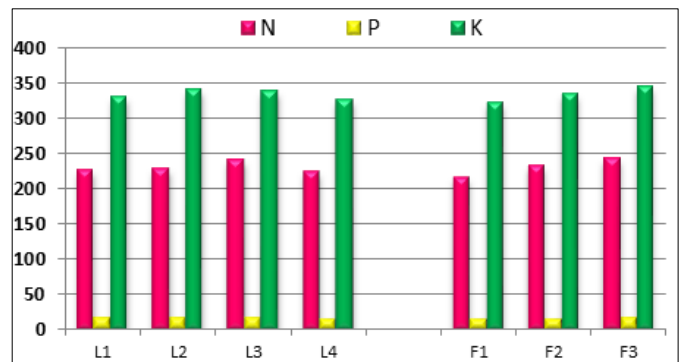
**Potassium**

Higher available potassium was recorded 1.50 m lateral spacing, 4 lph at 0.6 m spacing (L3) and it was on par with 1.20 m lateral spacing, 4 lph at 0.6 m spacing (L2) and it was followed by 0.90 m lateral spacing, 4 lph at 0.6 m spacing for cotton (L1). Control plot recorded in Lower Available potassium. (Fig. 1 & Fig 2.) Application of 125% of recommend N & K (L3) recorded higher available potassium and it was on par with application 100% of recommend N & K (L2). Available potassium was lower in control plot. Different on lateral spacing and fertilizer level did not have any significant influence on available potassium in both cotton and maize. Application of water soluble fertilizer through fertigations and wider lateral spacing might have distributed better through root zone of crop than straight fertilizers, thus ensure more available NPK and increased fertilizer use efficiency, growth, yield attributes and yield than other lower levels and soil application of fertilizers.

**Effect of lateral spacing & fertigation levels on Post-harvest soil available NPK (kg/ha) Cotton and maize**



**Fig 1:** Post-harvest soil available NPK (kg/ha) in cotton



**Fig 2:** Post-harvest soil available NPK (kg/ha) in Maize

**Conclusion**

The study inferred that, single economical drip layout of 1.20 m lateral spacing with 4 lph at 0.6 m spacing along with drip fertigation of 125% of recommend N and K recorded maximum benefits in terms of crop yield and gross return, net return Benefit cost ratio in both cotton and Maize.

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