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## Effect of potassium foliar fertilizer application on cotton yield, yield components and fiber quality, and nutrient use efficiency of three cotton varieties

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### ABSTRACT

An effective management strategy for potassium (K) foliar fertilizer was important to optimum cotton yield and fiber quality. The study was conducted in split-plot design with three replicates, and the basal potassium fertilizer application (90 kg K ha<sup>-1</sup>) plus five different K foliar rates (0 %, 0.5 %, 1 %, 1.5 %, and 2 %) and three varieties (Ngewchi-6, LGNC-4, and Shwe Daung-8). The K<sub>4</sub> (1.5 % K foliar) gave significantly increased seed cotton yield per plant (105.63 g), the highest seed cotton yield (1809.7 kg ha<sup>-1</sup>), the highest lint yield (607.4 kg ha<sup>-1</sup>), and cottonseed yield (1202.3 kg ha<sup>-1</sup>) in this experiment. The K<sub>4</sub> treatments gave the highest potassium uptake 1.87 and the highest dry matter content (164.39 g plant<sup>-1</sup>). The K<sub>1</sub> (control) formed the lowest potassium uptake 1.22 and the lowest dry matter amount (116.78 g plant<sup>-1</sup>). The high K-uptake was consistent with high seed cotton yield in K-foliar application (K<sub>4</sub>). Shwe Daung- 8 variety was responded on K-foliar application which produced on the plant the maximum number of fruit setting (70.14), the maximum number of total bolls (26.63), the maximum number of picking bolls (23.46), the percentage of opened bolls (87.58 %), and the lowest fruit shedding percentage (12.59 %). Therefore, experimental result showed that potassium fertilizer application is more important by cotton cultivars with K-rate and added % of K-foliar application in the efficient utilization for increased cotton production.

**Keywords - Potassium foliar fertilizer, Cotton yield, Fiber quality, and Dry matter**

### INTRODUCTION

Myanmar cotton production in 2018

- ❖ Production was 700 thousand (Unit of 1000, 480 lb. bales<sup>-1</sup>)
- ❖ Harvested area was 240 thousand hectare
- ❖ Domestic consumption was 775 thousand bales
- ❖ Rate of seed cotton yield as 635 kg ha<sup>-1</sup>
- ❖ Myanmar cotton production playing at the extensive route road (Ref.1)
- ❖ Both cotton yield and fiber quality –the availability of adequate and balanced plant nutrients

**K requirement for cotton production**

- ❖ Potassium - a vital nutrient in cotton production. (Ref.2)
- ❖ Potassium foliar applications offer mid-season deficiencies quickly and efficiently, especially in the late season when soil application of K may not be sufficient (Ref.3)
- ❖ Split utilization of potassium can help to reduce the effect of loss by leaching from sandy soil, low cation exchange capacity soils in high rainfall region. (Ref.4)

**Effects of K on Cotton Yield Components**

**In preliminary research results - K fertilizer rates**

90 kg K ha<sup>-1</sup> application significantly positives effects increased

- Total fruit setting 16 %
- Percent of opening bolls 18 %
- Boll weight 10 %
- Seed weight 5 %
- Seed cotton yield 41%
- Lint yield 40 %
- more than control treatment in the experiment of post-monsoon season, 2017



### OBJECTIVES:

To evaluate the effects of K fertilizer and addition of K- foliar spraying on plant growth, yield, yield components, and fiber quality of cotton

### MATERIAL AND METHOD

- Experimental Site - Aunglan Technological Farm  
Experimental Design - Split-Plot  
Experimental Area - 0.15 ha  
Plot size - 4.5 m × 7.5 m  
Spacing - 0.75 m × 0.75 m – 2 plants / hole  
Period; - 2018- monsoon (June -October)  
Main plot –three varieties 1. Ngwechi - 6 (140-150 days )  
2. LGNC - 4 (155-165 days )  
3. Shwe Daung - 8 (160-170 days )

Sub plot – Five K foliar fertilizer treatments

Treatments	Application Time		
	Bud formation (60 DAE)	Flowering (75 DAE)	Boll formation (90 DAE)
K 1 (0 %)	-	-	-
K 2 (0.5 %)	✓	✓	✓
K 3 (1.0 %)	✓	✓	✓
K 4 (1.5 %)	✓	✓	✓
K 5 (2.0 %)	✓	✓	✓

### Time of Fertilizer application

- ❖ Urea 180 kg (84 kg N ha<sup>-1</sup>) and Potash 110 kg (90 kg K ha<sup>-1</sup>) 25 % as basal, 50 % as beginning of square formation, 25 % as beginning of flowering
- ❖ T-super 124 kg ( 24 kg P ha<sup>-1</sup>) – 100 % of T-super as sowing time. This amount was used in all treatments
- ❖ F.Y.M 6 ton ha<sup>-1</sup> - F.Y.M was used application in all treatments

### Data Analysis :

Analysis of variance was performed by STATISTIX 8. treatments means compared with Least Significant Difference (LSD) at 5% level .

### Data calculation

**K uptake** = K concentration × dry matter weight

**K use efficiency (KUE)** =  $\frac{\text{Seed cotton yield}}{\text{Total K uptake}}$

**Partial Factor Productivity of Potassium (PFP–K)** =  $\frac{\text{Yield (kg ha}^{-1}\text{)}}{\text{Applied K (kg ha}^{-1}\text{)}}$

**Harvest Index (HI)** =  $\frac{\text{Economic Yield}}{\text{Biological Yield}}$  or  $\frac{\text{Seed Yield (kg ha}^{-1}\text{)}}{\text{Total Dry Matter (kg ha}^{-1}\text{)}}$

### RESULTS AND DISCUSSION

**Table (1) Mean effects of varieties and potassium foliar fertilizer rates on yield component parameters, in monsoon season, 2018**

Treatments	Fruit setting	Total bolls	picked bolls	Fruit shedding (%)	Opened bolls (%)	Boll weight (g)
Varieties						
Ngwechi-6	62.5	20.9 b	17.9 b	12.8 b	85.0 a	4.98
LGNC- 4	62.4	21.5 b	16.5 b	15.7 a	76.3 b	4.86
Shwe Daung-8	70.1	26.6 a	23.5a	12.6 b	87.6 a	4.74
LSD <sub>0.05</sub>	4.09	1.14	0.92	0.68	1.01	0.11
K- foliar						
K <sub>1</sub> (0%)	66.2	22.1	18.6 b	16.8a	83.8 abc	4.88
K <sub>2</sub> (0.5%)	64.9	23.6	18.6 ab	13.1bc	78.5bc	4.75
K <sub>3</sub> (1%)	63.9	22.1	17.3b	14.0b	74.81c	4.97
K <sub>4</sub> (1.5%)	64.6	22.4	20.6ab	13.0bc	91.9 a	4.75
K <sub>5</sub> (2%)	65.6	24.8	21.3 a	11.7 c	85.8ab	4.96
LSD <sub>0.05</sub>	3.91	1.02	1.24	0.77	3.34	0.11
P ≥ F						
Varieties	ns	**	**	**	**	ns
K-foliar	ns	ns	ns	**	**	ns
V & K	ns	**	**	**	**	ns
CV % (a)	24.39	19.16	18.57	19.31	4.71	9.06
CV % (b)	18.06	13.41	19.37	16.93	12.07	6.85

In each column, means having the same letter are not significantly different at 5 % significant level

**Table (2) Effects of varieties and potassium foliar fertilizer rates on yield and seed quality parameters, in the monsoon season, 2018**

Treatments	cotton yield (kg ha <sup>-1</sup> )	Lint yield (kg ha <sup>-1</sup> )	seed yield (kg ha <sup>-1</sup> )	1000 seed weight (g)	% of Seed germination
Varieties					
Ngwechi-6	1734.9	567.8	1167.1	105.7 ab	86.20
LGNC- 4	1657.3	556.7	1100.6	101.9 b	88.20
ShweDaung-8	1779.5	623.7	1155.7	107.2 a	87.67
LSD <sub>0.05</sub>	85.22	36.58	48.95	0.99	1.38
K- foliar					
K <sub>1</sub> (0%)	1586.2	536.2	1050.1	108.2	88.56 ab
K <sub>2</sub> (0.5%)	1755.7	597.9	1157.8	103.5	86.22 ab
K <sub>3</sub> (1%)	1694.3	578.6	1115.6	105.1	90.22a
K <sub>4</sub> (1.5%)	1809.7	607.4	1202.3	103.1	86.33 ab
K <sub>5</sub> (2%)	1773.5	593.6	1180.0	104.7	85.44b
LSD <sub>0.05</sub>	111.59	37.75	74.66	2.34	1.63
P ≥ F					
Varieties	ns	ns	ns	**	ns
K-foliar	ns	ns	ns	ns	ns
V & K	ns	ns	ns	ns	ns
CV % (a)	19.15	24.31	16.61	3.65	6.12
CV % (b)	19.42	19.43	19.63	6.69	5.60

In each column, means having the same letter are not significantly different at 5 % significant level

**Table (3) Mean effects of cotton varieties and different potassium foliar fertilizer rates on fiber quality parameters in the monsoon season, 2018**

Treatments	Ginning (%)	length (mm)	strength (lb./mg)	fineness (micronaire)	maturity ratio	Uniformity ratio
Varieties						
Ngwechi-6	32.65	28.78	8.03	4.26	0.95	91.31 b
LGNC-4	33.56	29.32	8.02	4.22	0.94	90.91 b
ShweDaung-8	35.13	28.99	8.09	4.52	0.96	92.21a
LSD <sub>0.05</sub>	0.48	0.18	0.04	0.11	0.0006	0.17
K- foliar						
K <sub>1</sub> (0%)	33.69	29.58	8.06	4.28	0.94 b	91.34
K <sub>2</sub> (0.5%)	34.05	29.08	7.94	4.29	0.94 b	91.04
K <sub>3</sub> (1%)	34.14	28.74	8.09	4.37	1.01 a	91.57
K <sub>4</sub> (1.5%)	33.55	28.82	8.06	4.40	0.93 b	91.97
K <sub>5</sub> (2%)	33.46	28.96	8.08	4.33	0.92 b	91.47
LSD <sub>0.05</sub>	0.38	0.23	0.04	0.11	0.02	0.44
P ≤						
Varieties	0.05	0.22	0.40	0.25	0.17	0.01
K-foliar	0.66	0.11	0.13	0.92	0.03	0.68
V & K	0.37	0.004	0.14	0.56	0.07	0.03
CV % (a)	5.47	2.41	2.01	10.27	2.48	0.73
CV % (b)	3.41	2.37	1.67	7.57	6.12	1.45

In each column, means having the same letter are not significantly different at 5 % significant level

**Table (4) Mean effects of cotton varieties and different potassium foliar fertilizer rates on total dry matter production in the monsoon season, 2018.**

Treatments	Dry Matter	K uptake	KUE	PFP-K	Harvest Index
Varieties					
Ngwechi-6	145.73	1.49	34.49 a	18.73	0.35
LGNC_4	147.51	1.67	30.14 b	17.91	0.33
Shwe Daung-8	144.40	1.60	30.96 b	19.26	0.35
LSD <sub>0.05</sub>	3.35	0.09	0.82	0.93	0.02
K- foliar					
K <sub>1</sub> (0%)	116.78 c	1.22 d	38.22 a	17.62	0.39 a
K <sub>2</sub> (0.5%)	137.98 b	1.52 c	32.72 b	19.24	0.37 ab
K <sub>3</sub> (1%)	157.63 a	1.62 bc	28.71 c	18.32	0.31 b
K <sub>4</sub> (1.5%)	164.39 a	1.87 a	28.71 c	19.30	0.33 ab
K <sub>5</sub> (2%)	152.62 a	1.72 ab	30.98 bc	18.67	0.33 ab
LSD <sub>0.05</sub>	4.24	0.07	1.06	1.21	0.03
P ≤					
Varieties	0.81	0.41	0.04	0.62	0.56
K-foliar	0.000	0.00	0.000	0.85	0.03
V & K	0.005	0.01	0.000	0.08	0.08
CV % (a)	8.91	21.43	9.94	19.23	18.04
CV % (b)	8.72	12.75	9.96	19.46	22.56

In each column, means having the same letter are not significantly different at 5 % significant level

**Table (5) Correlations coefficients of cotton varieties and different potassium fertilizer rates on yield and nutrient use efficiency parameters, during monsoon season, 2018**

	DM	K-Up	KUE	PFP
K-Up	0.8626**			
KUE	- 0.4402**	- 0.4736**		
PFP	- 0.1062	0.5482**		
HI	-0.0682	0.1279	0.4538**	0.3785

**Correlations much Related between -**  
DM & K-Up  
K-Up & KUE (-)  
KUE & HI

### CONCLUSION

- ❖ 90 kg K ha<sup>-1</sup> plus 2% foliar treatment gave the maximum total bolls & picked bolls per plant
- ❖ 90 kg K ha<sup>-1</sup> plus 1.5 % K foliar gave highest % of open bolls per plant, maximum seed cotton yield, lint yield, and seed yield
- ❖ 90 kg K ha<sup>-1</sup> plus 1.5 % K foliar treatment was good respond in Aunglan cotton Farm.
- ❖ Basal application N:P:K rate = 84 : 24 : 90 (kg ha<sup>-1</sup>) plus 1.5 % K foliar treatment increased seed cotton yield, lint yield and improved fiber quality
- ❖ Shwe Daung-8 variety was produced in the increase significant difference on highest bolls per plant, maximum seed cotton yield and lint yield low percent of fruit shedding per plant , cottonseed yield , maximum 1000 seed weight and seed germination % than other two varieties
- ❖ The 90 kg K ha<sup>-1</sup> plus 1.5% K foliar treatment gave the maximum amount of K-uptake & dry matter amount
- ❖ Supplemental all K-foliar application treatments significantly improved the dry matter amount and K-uptake more than no foliar treatment
- ❖ Variety factor was significantly different on KUE
- ❖ K- foliar factor was significantly different on dry matter amount, K-uptake, and KUE
- ❖ interaction effects between V & K-foliar application were highly significant for dry matter amount, K-uptake, and KUE

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### REFERENCES

1. Department of Planning (DoP), Myanmar Agriculture Sector in Brief, pp 26-28, 2018
2. K. Raja Reddy , F. Harry, Hodges, and Jac Varco. Potassium Nutrition of Cotton, Bulletin 1094, 2000.
3. D. M. Oosterhuis and B. R. Bondada. “Yield Response of Cotton to Foliar Nitrogen as Influenced by Sink Strength, Petiole, and Soil Nitrogen”. Journal of Plant Nutrition, 24, 413-422. https://doi.org/10.1081/PLN-100104969, 2001.
4. W.R. Thompson, Potassium Builds Cotton Yields and Quality, Potassium and Cotton Nutrition, No-6, 655 Engineering Drive, Suite 110, Norcross, Georgia, 30092-2837, Potash & Phosphate Institute (PPI). Item # 08-0002, Reference 93192. 1997

