

Event: 7th IPI-FAI Round Table in collaboration with IPNI
Date and venue: 20/3/2012; NAAS Committee Room No.1, NASC Complex, New Delhi
Theme: Refinement of K recommendations in Vertisols

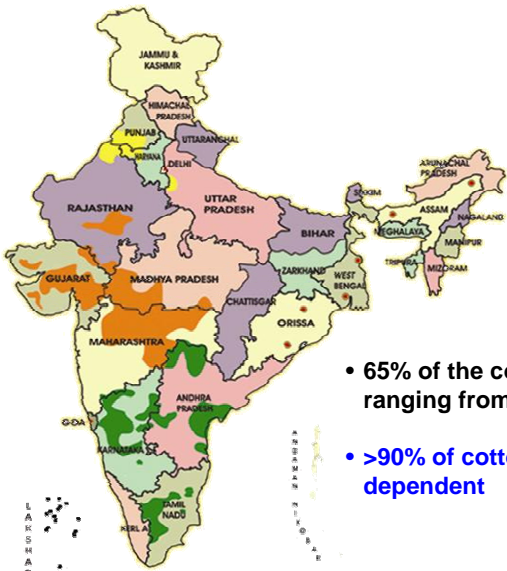


**Fertilizer-K recommendation for cotton grown on Vertisols:
Is there a need for revision?**




Blaise Desouza
Central Institute for Cotton Research
Nagpur

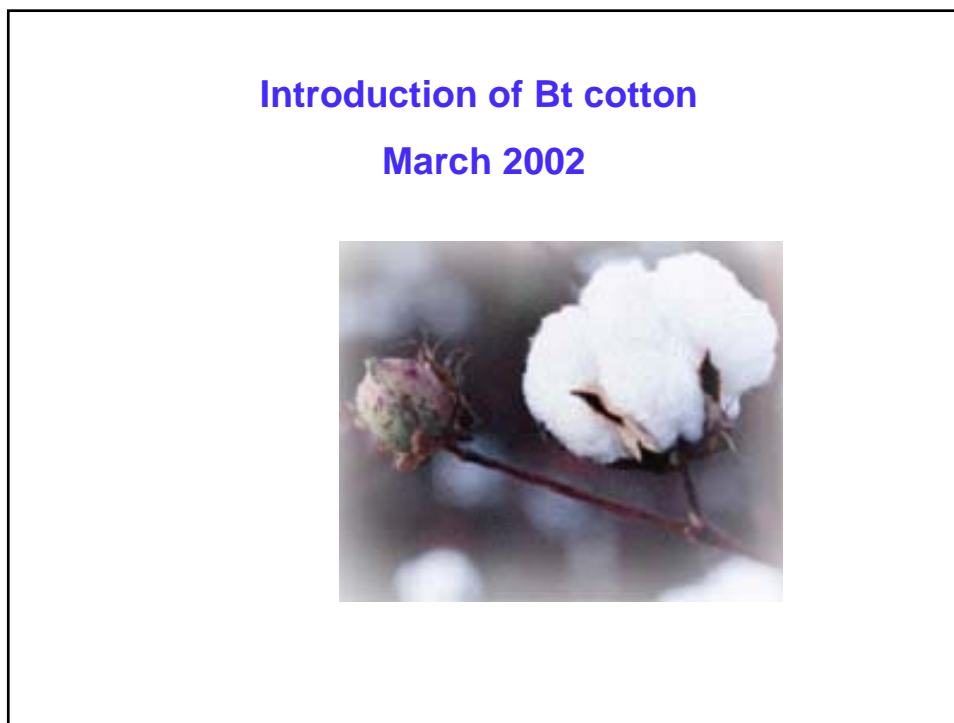
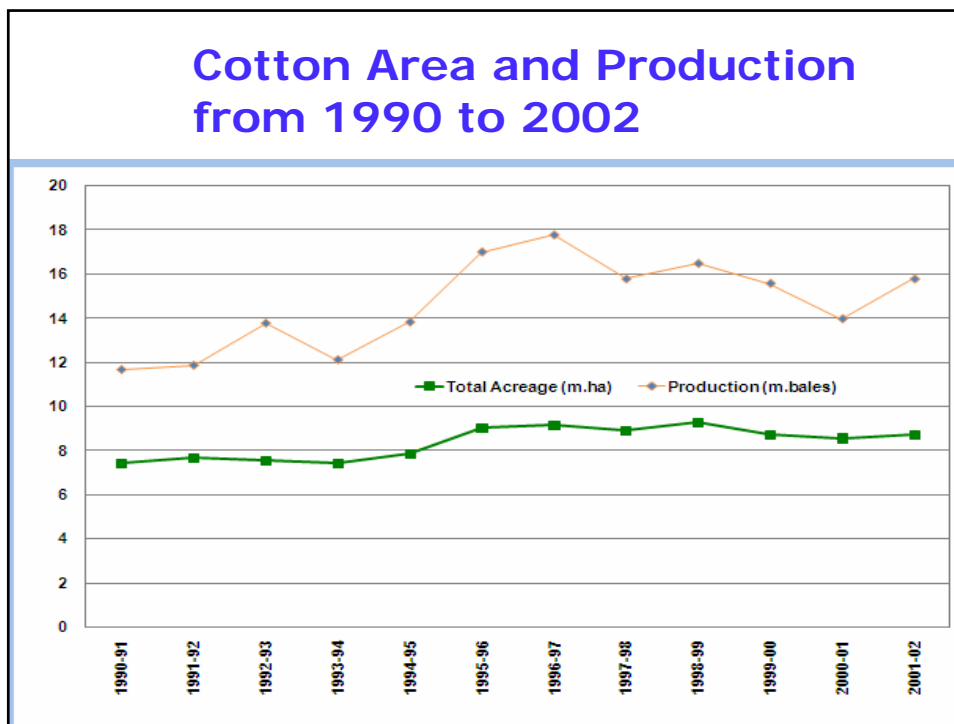
IRRIGATION VS DRYLAND COTTON IN INDIA



- 65% of the cotton crop is rainfed with rainfall ranging from 500 mm – 1500 mm.
- >90% of cotton grown on Vertisols is rain dependent

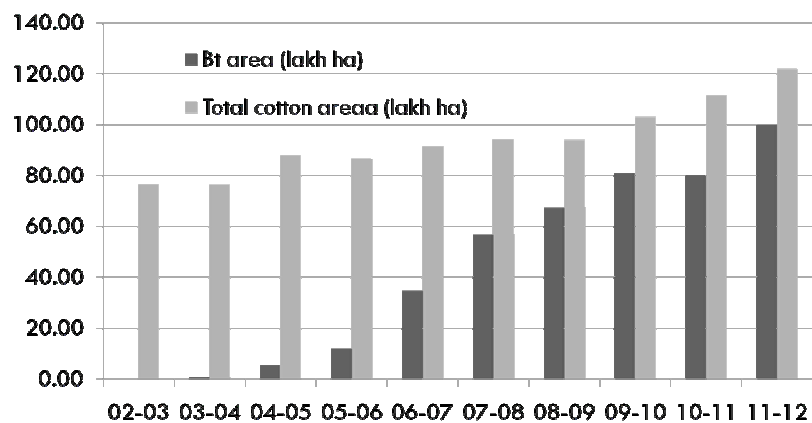


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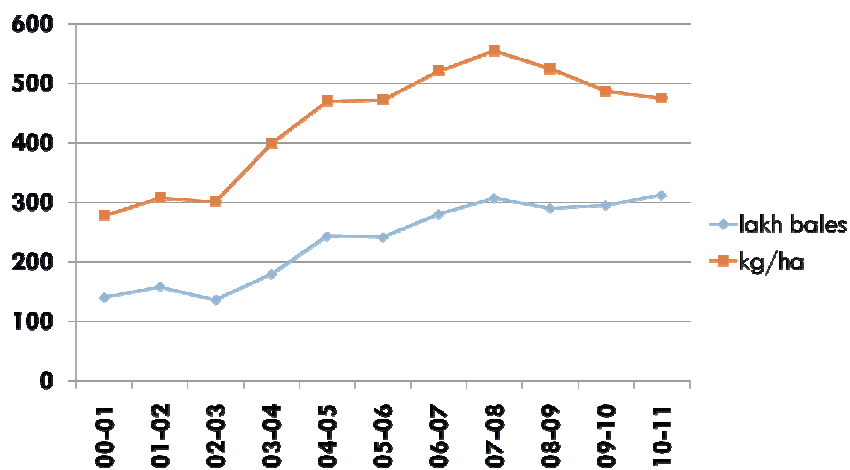


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Cotton area (lakh ha)



Cotton production and productivity

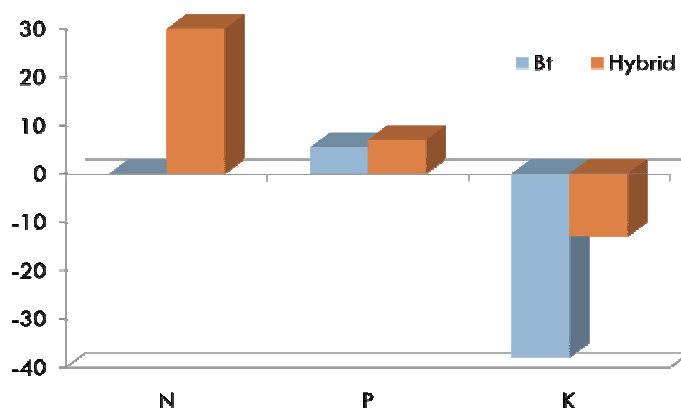


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Nutrient requirement (kg/Mg seed cotton)

| | N | P | K |
|----------------|-----------|----------|-----------|
| Lint & seeds | 24 | 4 | 10 |
| Stems & leaves | 22 | 1 | 23 |
| TOTAL | 46 | 5 | 33 |

Nutrient balance (kg/ha)



Blaise et al. (2005)

Role of K in cotton production

1. **Increases cotton productivity by increasing number, size and weight of bolls**
2. **Improves fiber quality properties (Read et al., 2004)**
3. **Increases water use efficiency and thus plant resistance to drought conditions**
4. **Reduces incidence and severity of pest and disease attacks**



- Among the major nutrients, N-P-K; N and P is applied by farmers at near recommended rates
- **Farmers seldom apply K, though it is equally important**
- Moreover, K is not included in the recommendations in some states

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K fertilizer recommendation (kg K₂O/ha) for cotton grown on Vertisols

| States | Desi cotton | Upland varieties | Hybrids and Bt hybrids | |
|----------------|--------------------|-------------------------|-------------------------------|-----|
| Maharashtra | 0 | 25 | 25 | 50* |
| Gujarat | 0 | 0 | 0 | 0 |
| Andhra Pradesh | 0 | 30/45* | 45 | 60 |
| Karnataka | 15 | 25 | 40 | 60 |
| Tamil Nadu | - | 20/40* | 40 | 60 |

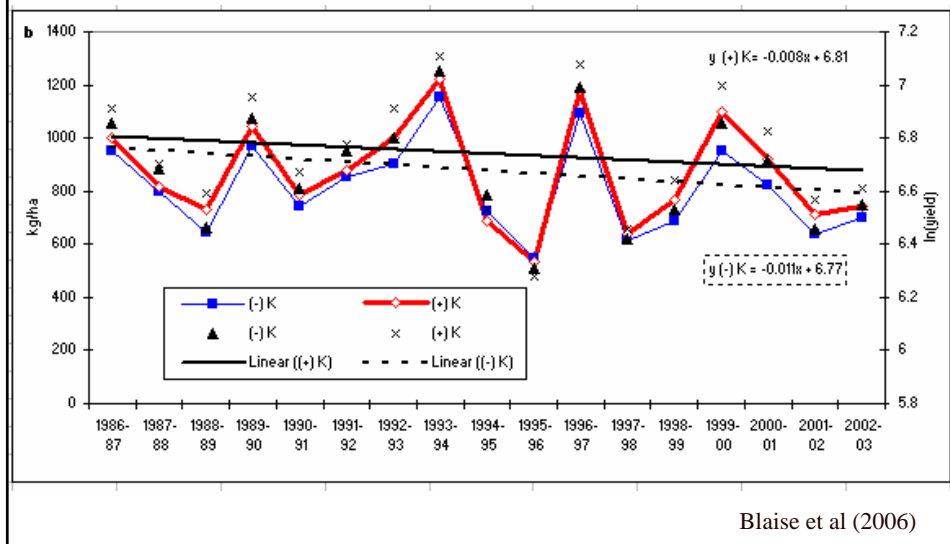
*irrigated

These are based on Agronomic trials under package of practices

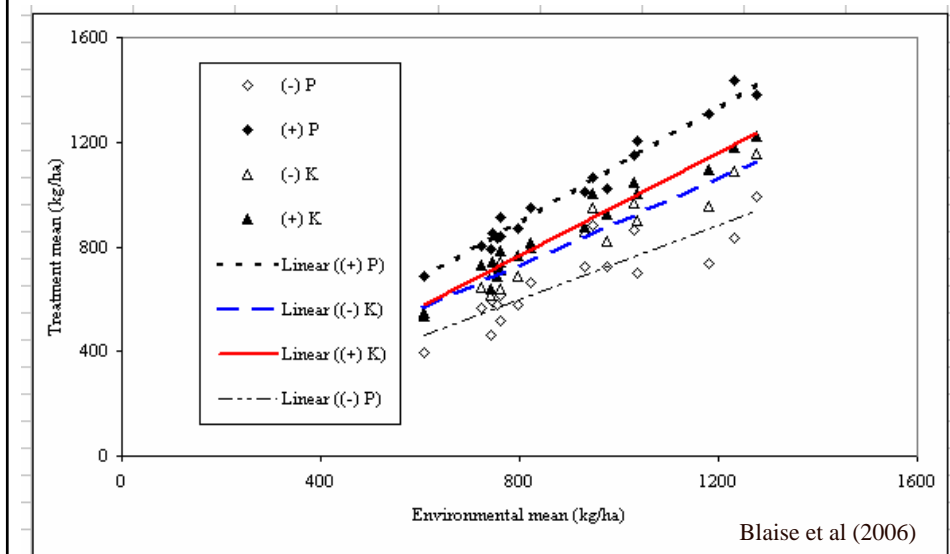
RESPONSE OF COTTON CULTIVARS (ASIATIC AND UPLAND) TO POTASSIUM

Results of experiments at CICR, Nagpur

Trend line with & without K application



Yield stability



- In general, cultivars did not respond to K application

(Pundarikashudu, 1987; Basu, 1992; Mannikar, 1993; Kairon and Venugopalan, 2001; Venugopalan and Pundarikashudu, 1999)

Factors

- Low yield levels – pest infestation
- Nutrient use efficiency? More efficient?

Efficiency?

- *G. arboreum* (desi cottons) more efficient than the *G. hirsutum* (American Upland cottons)
- High physiological efficiency

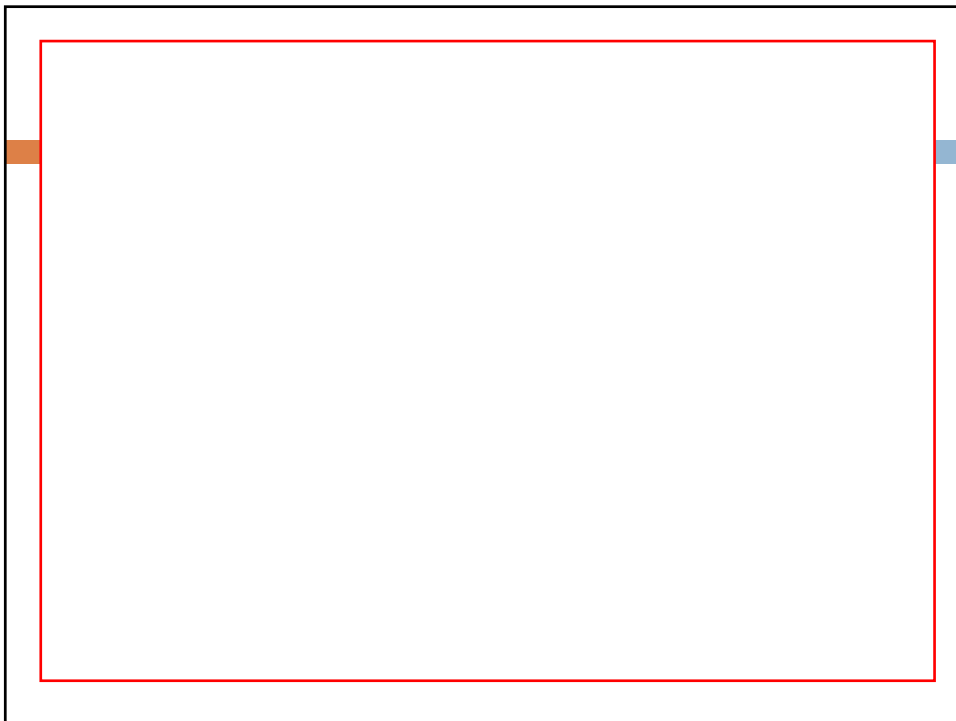
Venugopalan and Pundarikakshudu (1998)

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**Modern cultivars have high K
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boll loads**

**Premature senescence
syndrome/leaf reddening**



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On-farm results at Nagpur – Bt cotton response to K

| | Seed cotton | Response (kg/kg) | Pigeon pea grain |
|-----------------|-------------|------------------|------------------|
| Farmer practice | 710 | | 427 |
| NP | 778 | | 458 |
| NPK1 (22.5) | 875 | 4.3 | 485 |
| NPK2 (45) | 924 | 3.2 | 508 |
| LSD | 83 | | 21 |

Blaise et al. (2006)

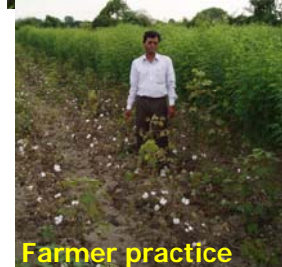
K fractions (mg/kg)

| | H ₂ O | NH ₄ COOCH ₃ | NEK |
|---|------------------|------------------------------------|---------|
| Soil1 Lithic Vertic Ustepts | 11 | 40 to 260 | 180-600 |
| Soil2 Typic Haplusterts Typic Chromusterts | 14 | >500 | >1000 |

Blaise and Singh (2006)

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Response to K on differing soils differing in K status



| | NP (kg) | NPK SC/ha) | Response (kg/kg) |
|--------|------------|---------------|---------------------|
| Soil 1 | 796 | 960 | 4.9 |
| Soil 2 | 960 | 997 | 1.1 |

Effect of K application on Bt cotton grown on Vertisols in Dharwad

| Treatments | Yield (Mg/ha) | Net returns (Rs./ha) | B:C |
|------------|------------------|-------------------------|------------|
| NP | 2.73 | 52,624 | 3.1 |
| NPK | 3.39 | 68,970 | 3.5 |

Biradar and Aladakatti (2011)

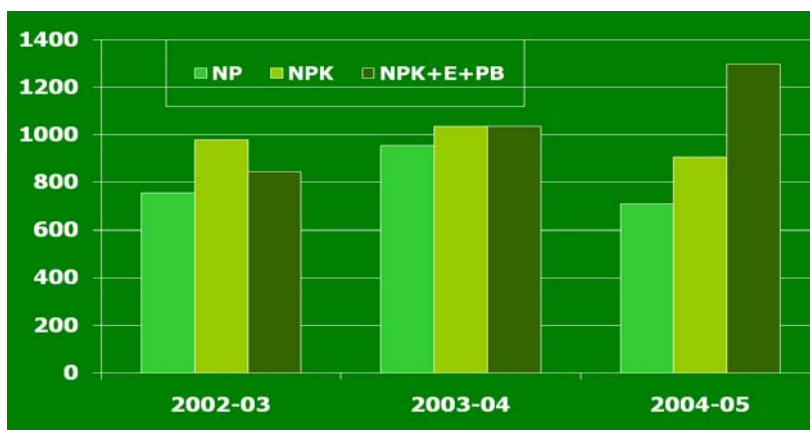
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DEMAND FOR K GREATER AT BOLL FORMATION STAGE

- **At peak boll formation soil moisture deficit is common due to receding rains**
- **Foliar application of K is a strategy to mitigate late season stress and meet crop demands**

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Effect of foliar-K on *G. hirsutum* cotton yield (kg/ha)



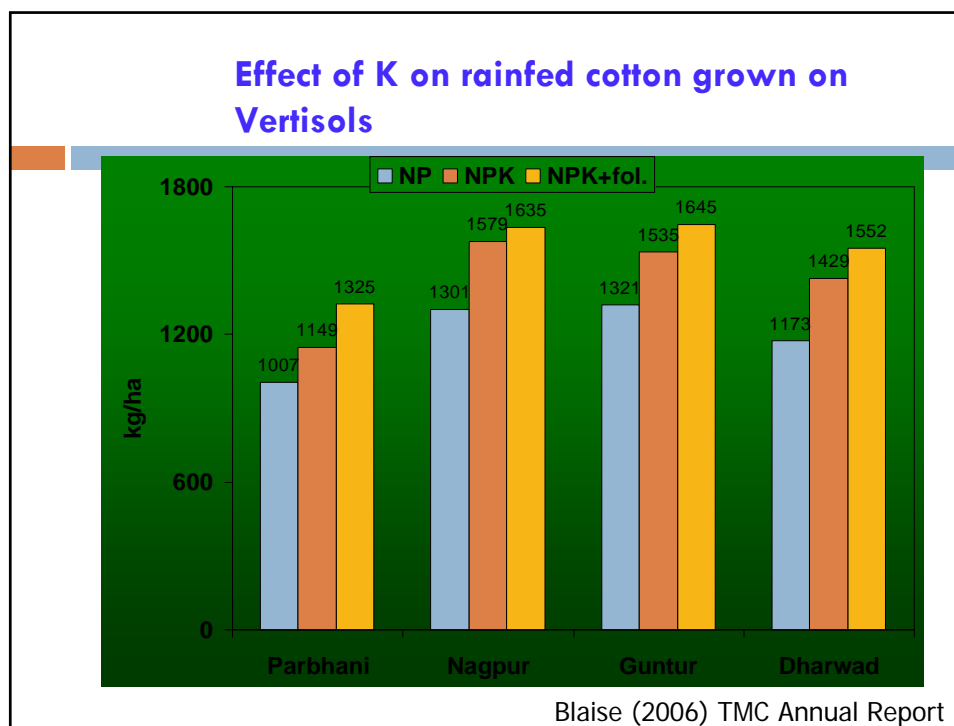
□ Response to K and foliar application of K observed in 2 of 3 years having less than normal rainfall

Blaise et al (2009)

Response of Bt cotton (kg/ha) to K

| Treatments | Seed cotton | Response (kg/kg) |
|---------------|-------------|------------------|
| NP | 1301 | |
| NPK | 1579 | 7.5 |
| NPK + EB & PB | 1635 | 7.8 (10) |
| LSD | NS | |
| CV(%) | 10.7 | |

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Present Status of K recommendations

Two states : Foliar K application at flowering and boll formation

Gujarat

Tamil Nadu

Punjab

Conclusions

1. Old cultivars did not respond to K
2. Response to soil applied K observed in Bt transgenic on farmers' fields
3. High yielding cultivars and hybrids responded to foliar K application
4. Response to K still not clear. Variable rates not studied

Future Research

- NEK pool of soil be estimated and correlated with cotton responses
- Cotton - sub soil K contribution?
- Considerable amount of K remains in the stalks. Recycling?

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Thank you for your patient hearing