Reducing Costs and Environmental Impact of Potato Late Blight Management: The Efficacy of a Simple Handheld Decision Support Tool

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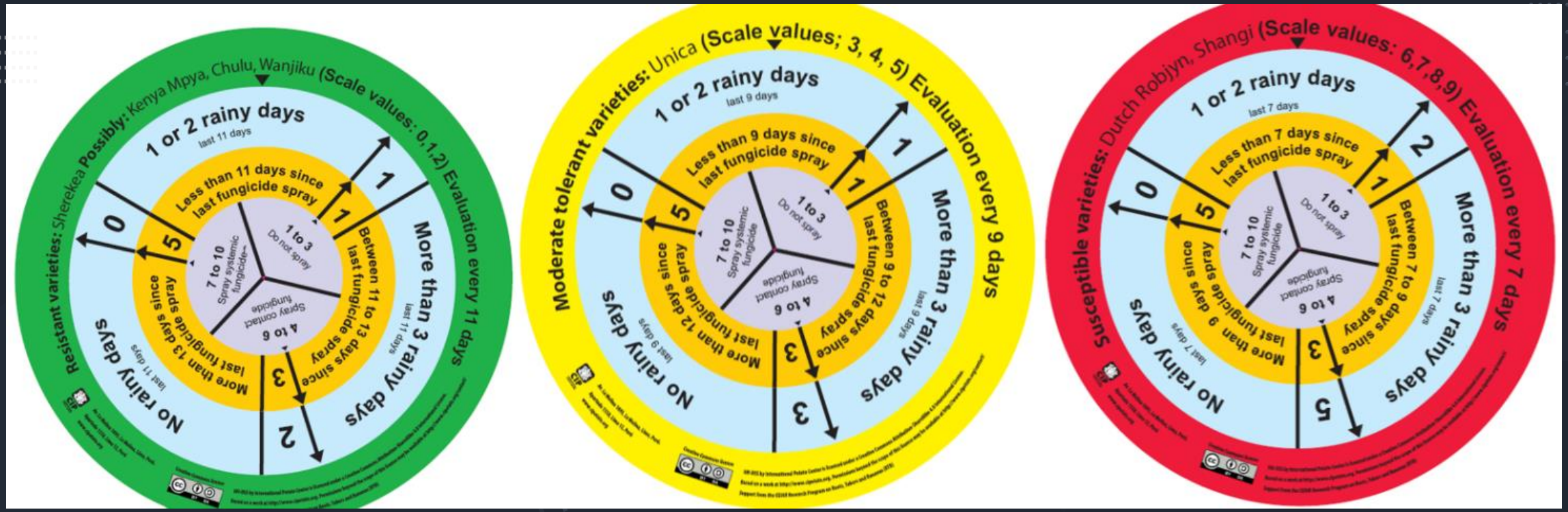
Background

- **Late Blight:** a major threat to Kenya's potatoes.
- **Favorable environment:** high humidity>80%, cool temperatures 6-15 °C; 5 to 14 sprays in a season -susceptible varieties.
- **Impacts:** environment, yield (up to 100% loss).
- **Cost:** high management expenses.
- **Risk:** health of applicators and potato consumers.
- **DST:** Use decision support tools for effective management become necessary.



The Decision Support Tool

Developed by CIP

Inexpensive and easily integrated into extension

- **Consists of 3 disks representing host resistance classes**
- **Each disk has revolving circles for number of rainy days and days since last fungicide spray**
- **Rotating circles gives different factor levels, resulting in spray recommendation**

- **As part of validation, the DST was evaluated in long rains of 2022, Central Kenya (2500 masl).**

Variety

Variety	Scale value	Susceptibility class
Sherekea	2.9	Resistant
Shangi	7.4	Susceptible

Spray Regime

1. Weekly LB Control
2. DST Guided LB Control
3. No LB Control


Farmate

Comparisons were made for

i. The number of fungicide applications scheduled
ii. Disease pressure measured as AUDPC and rAUDPC
iii. Disease suppression relative to the unsprayed control
iv. Cost benefit analysis

- **All treatments received first contact spray at 80% emergence.**

- **Weekly and DST recommended sprays were initiated 35 days after planting and continued until end of season.**

Fungicides Used

Selection based on

a. Effectiveness, greater the better

b. Availability in local stores

c. EIQ, the lower the better

d. Price, the lower the better

Product Trade Name	Category	Active ingredients (AI)	Fungicide Families or Groups	AI g/kg or L	Per ha dose in kg or L	base EIQ
Antracol WP 70	Protective	Propineb	M3	700	2.0	16.90
EquationTM Pro	Systemic	Famoxadone	11	225	0.4	10.36
		Cymoxanil	27	300		35.48
Infinito		Fluopicolide	43	62.5	1.6	26.00
		Propamocarb HCL	28	625		26.50
Milraz WP 76		Propineb	M3	700	2.0	16.90
		Cymoxanil	27	60		35.48
Revus 250SC		Mandipropamid	40	250	0.4	27.14

Fungicide Effectiveness Matrix Deployed

Weather Conditions	EquationTM Pro	Infinito	Milraz WP 76	Revus 250SC	Antracol WP 70	Jungle
Low humidity, low rainfall (LH-LR)	High	High	High	High	High	High
High humidity, low rainfall (HH-LR)	High	High	High	High	Moderate	Moderate
Low humidity, high rainfall (LH-HR)	High	High	High	High	Low	Moderate
High humidity, high rainfall (HH-HR)	High	High	High	Low	Low	Low

Data Collection

Defined as the reduction in AUDPC due to the treatment

Cost Benefit Analysis

Disease suppression

$$Disease\ suppression = \frac{AUDPC_{unsprayed} - AUDPC_{treatment}}{AUDPC_{unsprayed}}$$

Environmental Impact

$$EI\ per\ ha = EIQ * [dosage\ ha^{-1}]\ x\ \%active\ ingredient\ x\ no.applications$$

Total cost = (fungicide cost + spraying labour cost)*total number of sprays + DST cost

Gross benefit = fresh tuber yield * market price

Net benefit = Gross benefit- Total Cost

Results

Weather Data Measured During Study Period

Month	Average ambient Temp, °C	Average RH, %	Cumulative Rainfall, mm	Cumulative Irrigation, mm
Apr	13.0	78.6	0.6	-
May	13.3	83.6	126.4	-
Jun	11.8	85.6	34.6	20.5
Jul	11.0	88.6	14.4	34.4
Aug	10.5	95.7	4.4	-
Grand Total	12	86.3	180.4	54.9

Number of Sprays Over Season

Variety	Treatment	Antracol	EquationTM Pro	Infinito	Milraz	Revus	Total sprays
		Number of sprays					
Shangi	Weekly Spray	2	3	3	3	1	12
	DST	2	2	1	2	1	8
	No LB Control	1	-	-	-	-	1
Sherekea	Weekly Spray	2	3	3	3	1	12
	DST	1	1	1	1	-	4
	No LB Control	1	-	-	-	-	1

Disease Pressure

Variety	Treatment	AUDPC	rAUDPC	Disease suppression (%)
Shangi (susceptible)	Weekly Spray	361c	0.043c	92.1
	DST	279c	0.033c	93.9
	No LB control	4547a	0.541a	-
Sherekea (resistant)	Weekly Spray	4d	0.000d	99.7
	DST	14d	0.002d	99.0
	No LB control	1421b	0.169b	-

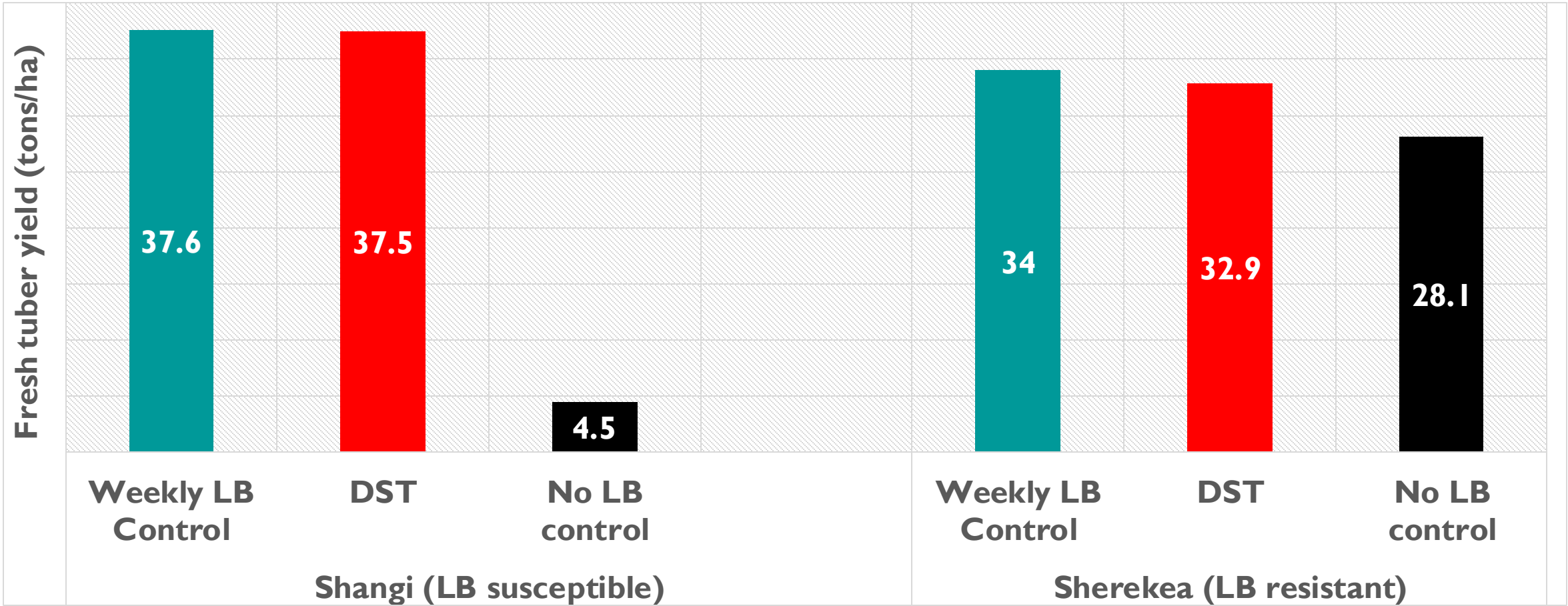
DST effectively reduced disease pressure to the same level as weekly sprays

Disease severity for Shangi (susceptible variety), 2.5 months after planting

Disease severity for Sherekea (resistant variety), 2.5 months after planting

Yield

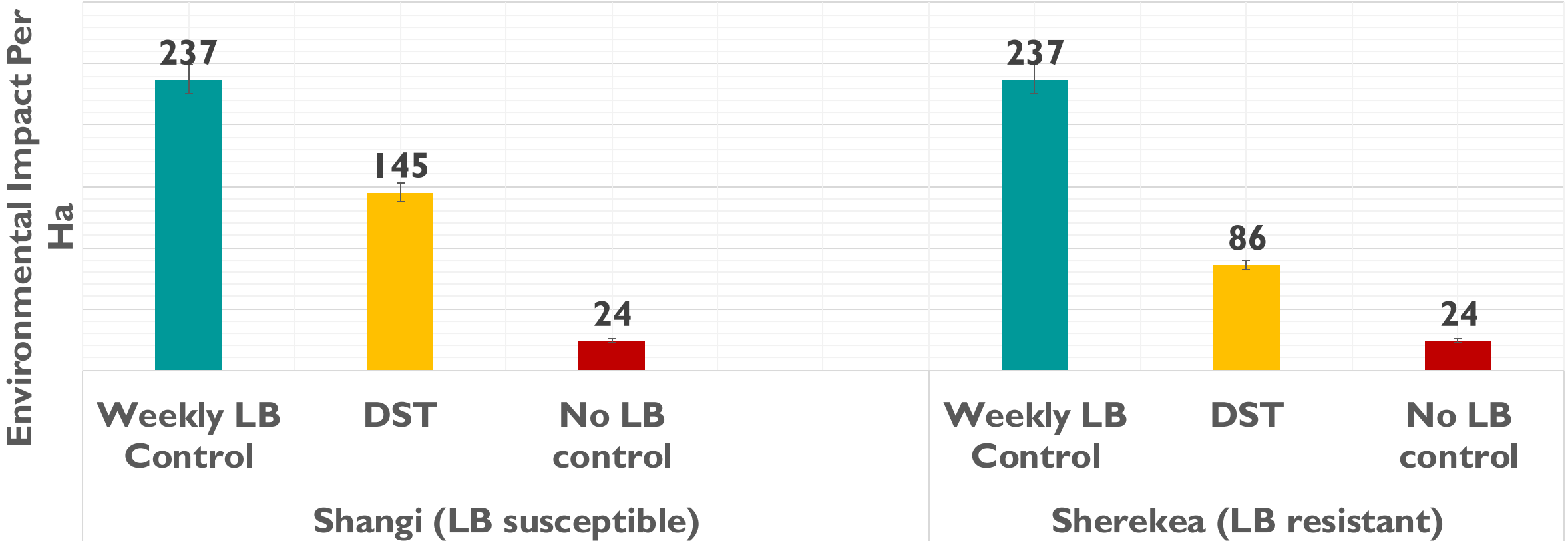
- **Weekly and DST regimes resulted in statistically similar fresh tuber yield.**
- **No yield effect from disease in the no LB control regime for Sherekea compared to the weekly and DST regimes, as the disease only damaged foliage after tuber filling and bulking.**



Different treatment combinations at harvest

Environmental Impact

- **DST resulted in a significantly lower environmental impact from fungicide spray compared to weekly regimes.**



Cost Benefits of DST

- DST regimes provided higher net benefit over weekly spray regimes

Variety	Treatment	Total sprays	Fungicide cost (USD/ha)	Cost of spraying (USD/ha)	Cost of DST (USD/ha)	Total cost (USD/ha)	Gross benefit	Net benefit	Net income over fungicide cost
Shangi (susceptible)	Weekly Spray	12	330	427	-	757	13,160	12,403	4,076
	DST Spray	8	205	284	3	492	13,125	12,633	9,189
	No LB control	1	16	36	-	52	1,575	1,523	1,523
Sherekea (LB resistant)	Weekly Spray	12	330	427	-	757	11,900	11,143	2,816
	DST Spray	4	109	142	3	254	11,515	11,261	10,499
	No LB control	1	16	36	-	52	9,835	9,783	9,783

Conclusion

DST implementation can lead to improved yield, reduced environmental impact, and cost reduction

Thus, leading to increased profitability and sustainability of LB management.

The reduced number of sprays with DST has potential benefits on health of applicators.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