



GroMore

A Crop Program for Sustainable Rice Productivity

KeeFui Kon, Ben Wu and Vinod Shivrain

Classification: PUBLIC

What we called GroMore is...

A crop program of good agricultural practices especially the crop protection protocol to sustain rice productivity.

Value of crop protection in rice

- Experimental plots: 37% yield loss without crop protection
 - Weeds above the crop 20%
 - Weeds below the crop 20%
 - Individual pests 2%
 - Individual diseases 1-10%
- On-farm surveys: 24-41% yield loss with farmer practices

Savary S., Willocquet L., Elazegui F.A., Castilla N.P., and Teng P.S. 2000. Rice pest constraints in tropical Asia: quantification of yield losses due to rice pests in a range of production situations. *Plant Disease* 84 (3):357-369.

Decisions on crop protection is progressive



- >80% smallholders
- Affordability of products and thus program
- Investment costs versus yield returns

Hypotheses

H0: Investment in any crop phase or its combination of phases makes no difference to the final yield

H1: A consistent investment in crop protection inputs from planting to heading is necessary to secure yield.

DOE approach | multi-factorial crop program

- Cost effective
 - Design treatments (runs) to match budget
- Flexible
 - Select replications to match resources

Allocation of trials

Trial	Production environment	Location	Production system	Variety
1	West Java	Cikampek	Transplanted rice	Ciherang
2	West Java	Cikampek	West-sown directed seeded rice	Ciherang
3	West Taiwan	Pingtung	Transplanted rice	TS10
4	West Taiwan	Pingtung	West-sown directed seeded rice	TS10

Treatment list

Program	Treatment		Basic	Seedling	Vegetative		Reproductive			Ripening			No. products applied
				SO/TR	AT	MT	PI	ME	HE	ER	MR	AR	
			Golden apple snail	Weeds	Stemborer / leaf folder	Stemborer / leaf folder	Sheath blight	Neck blast	Sheath blight	Neck blast	Stemborer / leaf folder	Stink bugs	
1	M		M										1
2	M	SV	M	H	I	I							4
3	M	SVR	M	H	I	I	F	F	F				7
4	M	SVRG	M	H	I	I	F	F	F	F	I	I	10
5	M	SV G	M	H	I	I				F	I	I	7
6	M	RG	M				F	F	F	F	I	I	7
7	M	SVRG	M	H	I	I	F	F	F	F	I	I	10

Treatment

- Set threshold at 1% crop injury
 - RIFIT (transplanted rice)
 - SOFIT (direct-seeded wet-sown rice)
 - VIRTAKO (stem borers and leaf folders)
 - ARMURE (sheath blight)
 - AMISTAR Top (sheath blight and neck blast)
 - MATADOR (stink bugs)
- Spray volume at 300 L/ha



Statistical model | all factors as main effects

- Yield = mean + crop programs + variety + production system + no. of products + error

Statistical model | only significant factors

- Yield = mean + crop program + variety + production system + error

Model fit | summary

- No obvious evidence of lack of fit
- Model is significant ($P < 0.0001$) and $R^2 = 0.82$.
- Three model terms are significant ($P < 0.05$)
 - Crop program (treatment)
 - Variety
 - Production system

Variety | TS10 yielded higher than Ciherang

Variety	Yield (kg/ha)	Panicles (no/m ²)	Grains (no/panicle)	TGW (g)
TS10	6315 a	191 b	116 a	22.8 b
Ciherang	5100 b	255 a	87 b	23.8 a

Note:

Student's t-test within column comparison

Production system | TR yielded higher than DSWS

Variety	Yield (kg/ha)	Panicles (no/m ²)	Grains (no/panicle)	TGW (g)
TR	6207 a	229 a	103 a	23.4 a
DSWS	5208 b	216 a	100 a	23.3 a

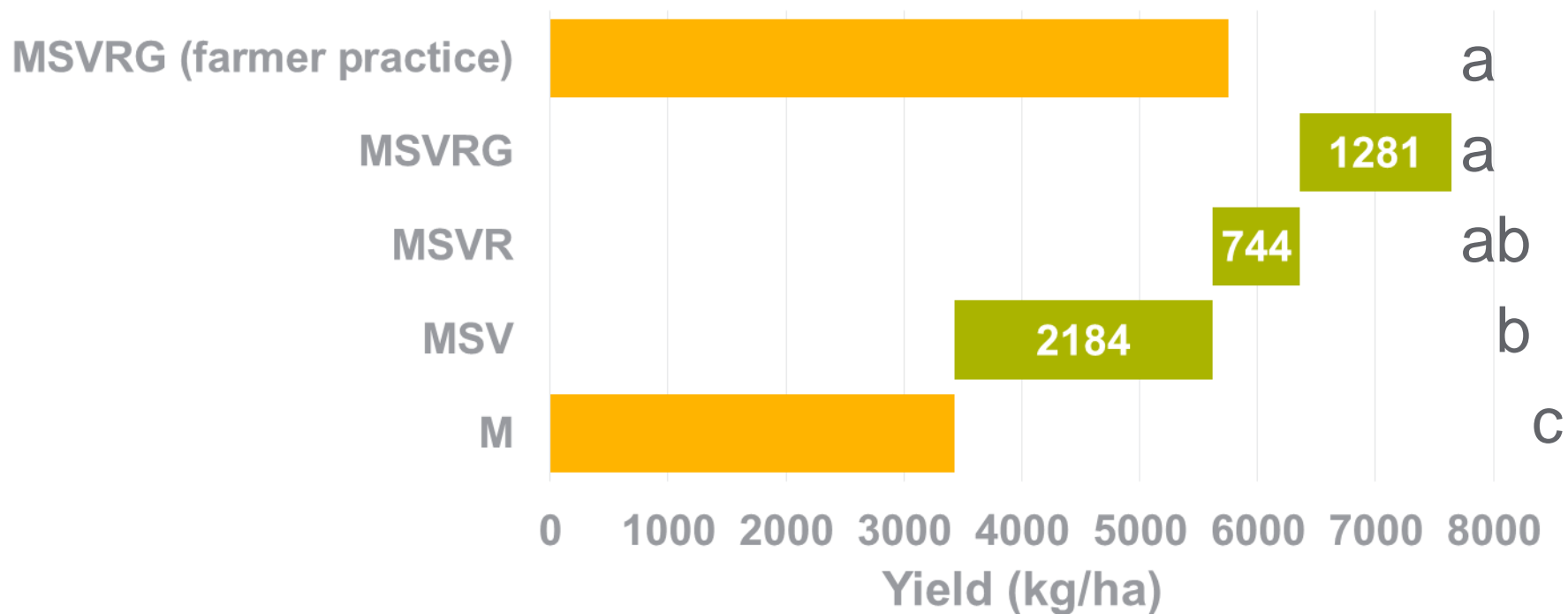
Note:

Student's t-test within column comparison

Biotic stresses | weed cover and injury

Crop program	Weed cover (%)	Pest injury (%)	Disease injury (%)
M	100 a	18 a	62 a
MSV	3 b	3 b	52 ab
MSVR	3 b	2 b	15 bc
MSVRG	3 b	2 b	9 c
MSVRG (farmer practice)	9 b	4 b	30 abc

Progressive investment of inputs | yield



Impact of crop protection inputs on crop biomass

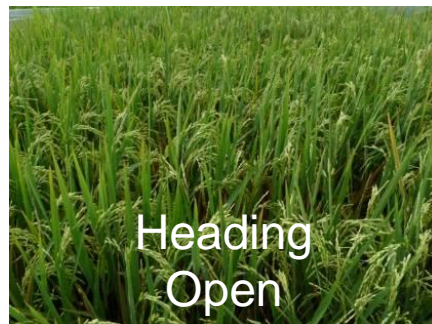
Direct-seeded wet-sown rice: compact equals high crop biomass

M

MSV

MSVR

MSVRG (farmer)



Impact of crop protection inputs on crop yield

Direct-seeded wet-sown rice: sample yield at 5 m²

M

MSV

MSVR

MSVRG (farmer)



Conclusions

- Status quo on crop protection investment irrespective of phases is rejected
- Progressive investment from planting to heading is optimum
- Major weeds, pests and diseases must be managed well to realise the yield potential

Questions?



Extra

Crop programs | multiple comparisons

Treatment	-Treatment	Difference	Std Error	t Ratio	Prob> t
Nicosamide	SV G	-2270.75	568.6080	-3.99	0.0114*
Nicosamide	RG	-2017.00	568.6080	-3.55	0.0292*
Nicosamide	Farmer practice	2317.25	568.6080	-4.08	0.0096*
SV	SVR	-744.00	568.6080	-1.31	0.8398
SV	SVRG	-2025.25	568.6080	-3.56	0.0284*
SV	SV G	-87.25	568.6080	-0.15	1.0000
SV	RG	100.00	568.6080	0.29	0.9999
SV	Farmer practice	-133.75	568.6080	-0.24	1.0000
SVR	SVRG	-1281.25	568.6080	-2.25	0.3148
SVR	SV G	850.00	568.6080	1.16	0.9022
SVR	RG	916.50	568.6080	1.60	0.6832
SVR	Farmer practice	610.25	568.6080	1.07	0.9285

GAS control alone fell short of the potential yield

CP in SV only was still short of the potential yield

CP in SVR only was closest to the potential yield