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Multi-stress tolerant Green Super Rice in the Philippines. Cost benefit analysis based on field testing of some lines of Green Super Rice

SUMMARY:

This technology describes the testing of multi-stress tolerant Green Super Rice (GSR) varieties in the Philippines. The benefits and constraints compared to local varieties are shown in a cost-benefit analysis.

KEYWORDS:
Climate change [1]
Adaptation [2]
Rice [3]
Philippines [4]
Drought [5]
Floods (inundations) [6]
Pests [7]

CATEGORY:
Climate change and disaster risk reduction [8]
Crop production [9]

COUNTRIES:
Philippines

DESCRIPTION:

1. Benefits of cultivation Green Super Rice (GSR) varieties

This technology describes the benefits of the cultivation of Green Super Rice (GSR) varieties in the Philippines, compared to local traditional varieties.

Green Super Rice lines are multi-stress tolerant, inbred, non-GMO rice lines developed by Chinese researchers of the Chinese Academy of Agricultural Sciences in 2011. They are conventionally bred non-GMO varieties and at the time of writing, they are being developed and tested in Africa and South Asia, including by the government of the Philippines. Research **rice lines** are those currently-undergoing the screening process of the National Seed Industry Council (NSIC). In the context of the project, these were cultivated in a manner that is supervised and monitored by the Department of Agriculture in collaboration with IRRI-GSR project. **Varieties** or registered varieties, on the other hand, are those that have passed the NSIC screening process and are authorized for commercial release/use.

Green Super Rice lines are tolerant to different types of stresses, including abiotic stresses (e.g. drought, salinity, alkalinity, iron toxicity), diseases (e.g. blast, bacterial-leaf-blight, sheath blight, bacterial leaf streak and false smut), and insects (e.g., brown planthopper, green leafhopper, stem borer) and could thus be used across a variety of hazard backdrops and agro-ecosystems

On February 2017, the GSR line commonly known as GSR 8, has been approved as a new variety with the registered name ?Rc480' and is now available for commercial use. It has also been noted by the Government certifying body as the ?standout' variety in this newly approved batch of 25 varieties.

Table 1 summarizes the different traits of Green Super Rice lines.

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Figure 1. Green Super Rice field in Camarines Sur, Philippines

According to figures published by the World Bank, in 2014 agricultural production in the Philippines represented 11.3% of the GDP, with rice being the main crop produced in the country. At the same time, the Philippines is one of the most disaster-prone countries in the world due to its high vulnerability to natural hazards such as droughts, floods and typhoons. In order to cope with these recurrent hazards, multi-stress tolerant rice lines and varieties are tested by research institutes and implemented across the Philippines. These multi-stress tolerant rice lines include GSR but also traditional/indigenous, conventionally-bred, modern-biotech and hybrids.

The Green Super Rice (GSR) lines cultivated in the communities where data was gathered (256 farms in Bicol and Caraga Regions of Philippines) are GRS1, GRS5a, GRS8, GRS11, GRS12a (tolerant to drought, flood and saline conditions). Since, rice is an important staple crop in the Philippines, increase in yields and production quantities due to enhanced resilience to extreme events could strengthen food security among vulnerable smallholder households.

GSR Line	**Traits**	**Maturity days**
GSR5A	Low-input, saline-, drought- submergence tolerant, aromatic	115

GSR8 (now registered variety Rc480)	Low-input, saline-, drought-, submergence tolerant	105
GSR12A	Drought-, saline tolerant, aromatic	115
GSR1	Low-input, saline-, drought tolerant	110
GSR11	Drought-, saline tolerant, cool elevated	110

Table 1. Green Super Rice lines and their traits

2. Cultivating GSR

The cultivation of GSR in the project was done in a way similar to that of local varieties with the standard site-specific adjustments in cultural management activities such as applying fertilizers and other supplements based on plot-level soil fertility and other site-specific variables/characteristics (e.g. whether the farm is often waterlogged/flooded) and risks (e.g. pest and diseases).

Inputs distributed to the project beneficiaries in addition to the GSR seeds include Complete fertilizer (NPK), Ammosul, Muriate of Potash and Zinc Sulfate, and Organic Fertilizer.

Farmers were trained and regularly coached by the project team to ensure proper management practices, including necessary risk-reducing practices such as split application of fertilizers, cleaning of drainage canals and increased monitoring for early signs of weather-associated pests and diseases.

3. Cost-Benefit Analysis of the Practice

The performance of Green Super Rice (GSR) lines 1, 5a, 8, 11, 12a were assessed at farm-level in 35 farms in the Philippines based on quantitative data collected during the monitoring period during three consecutive seasons:, i.e. the 2015 dry and wet seasons, and the 2016 dry season.

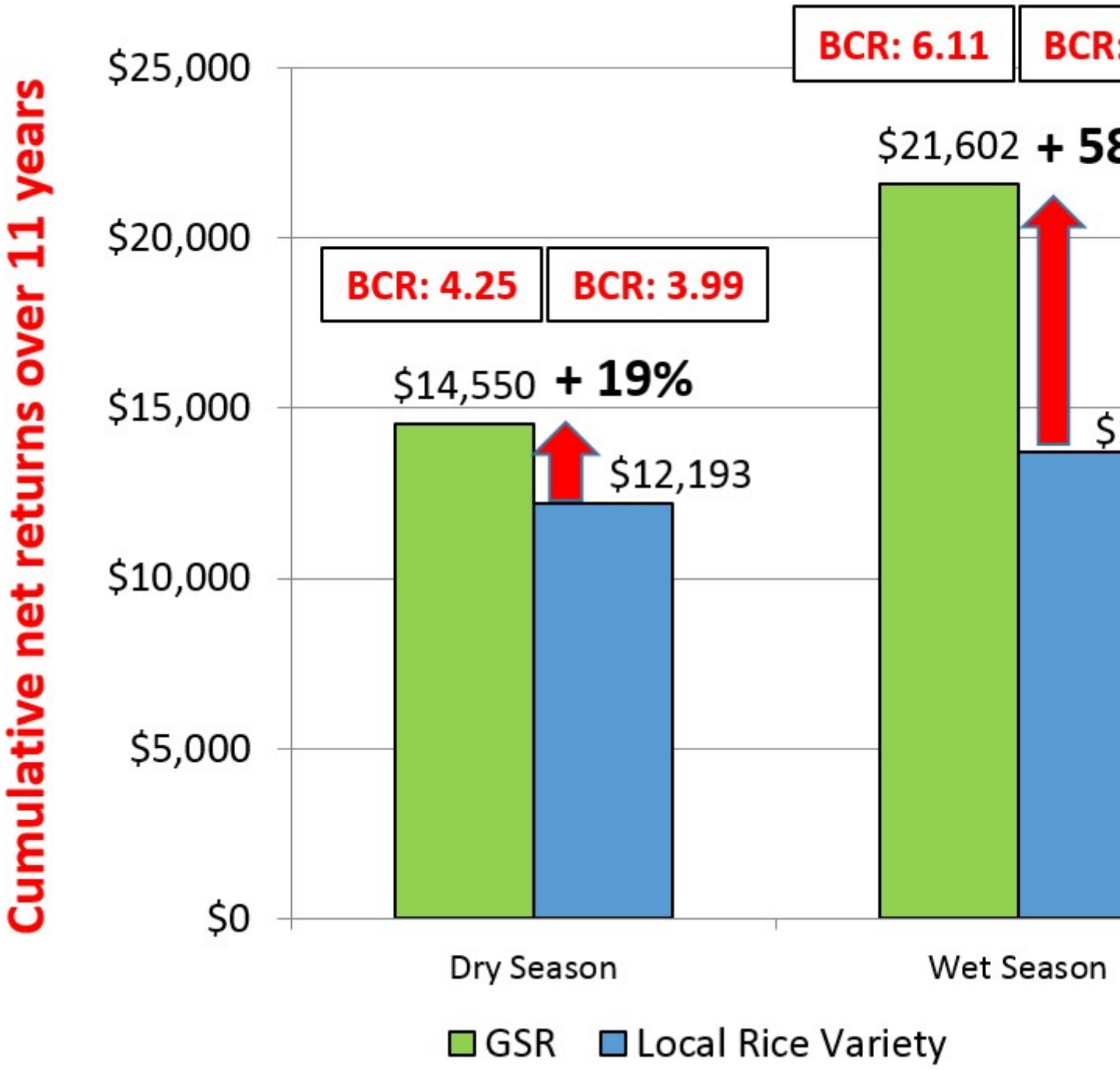
The sample included 35 farms in Bicol and Caraga Regions of Philippines, specifically in Camarines Sur (2), Camarines Norte (6), Masbate (7), Catanduanes (5), and Surigao del Norte (15) districts. The sites for these demonstration farms have been specifically chosen because they are located in communities where flood, drought and saltwater intrusion are prevalent. In these areas, farmers often have to live with reduced yield because of these hazards.

Results were used to conduct a cost-benefit analyses of Green Super Rice and local rice varieties under non-hazard conditions and various hazard conditions, mainly dry spell and drought, floods, pests and delay in the rainy season (time frame: 11 years).

The net benefits obtained from Green Super Rice lines were measured through a cost-benefit analysis (CBA), and compared to the net benefits of local rice varieties. The CBA projects the cumulative net present value of benefits obtained from 1 hectare of rice over a period of 11 years (10 percent discount rate is applied to express the future value of costs and benefits in present terms), as well as the benefit-cost ratio (BCR), which is the ratio between total discounted benefits and total discounted costs over the appraisal period.

Figure 2 provides an overview of the outcome of the CBA **in non-hazard conditions**. In particular, it shows that:

- During the dry season, the net benefit over 11 years is 19% higher in farms that adopt Green Super Rice, as compared to non-adopters. During the wet season, the increase in the net benefit of Green Super Rice adapters is even bigger, amounting to 58%.
- The BCR of cultivating GSR lines is higher than that of producing local varieties, in both dry and wet seasons.

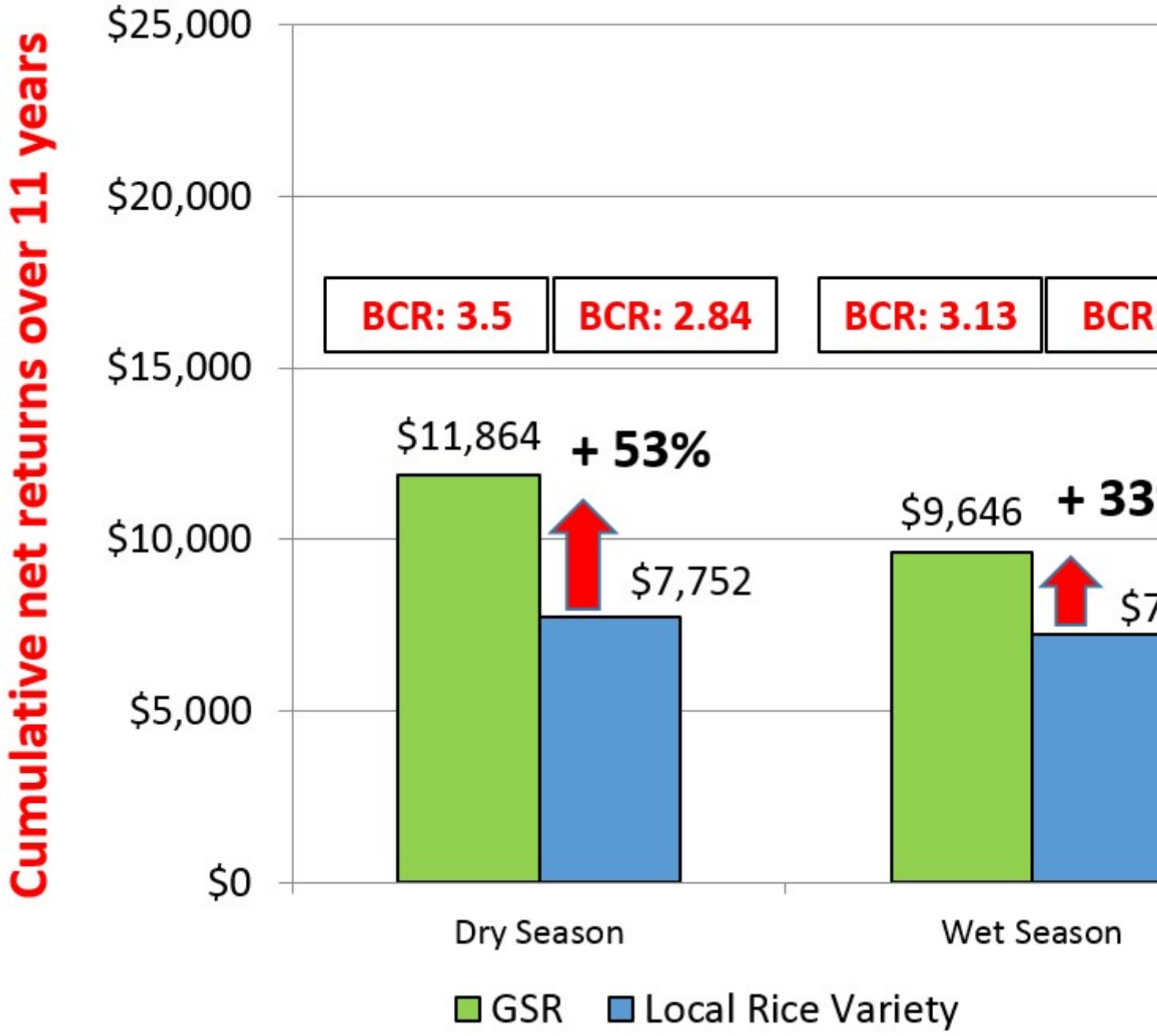


[11]

Figure 2: Cumulative Net Benefits and Benefit Cost Ratios of Good Practice and Local Practice ($ per hectare per season): ***Non-hazard conditions***

Figure 3 provides an overview of the outcome of the CBA **in hazard conditions**. In particular, it shows that:

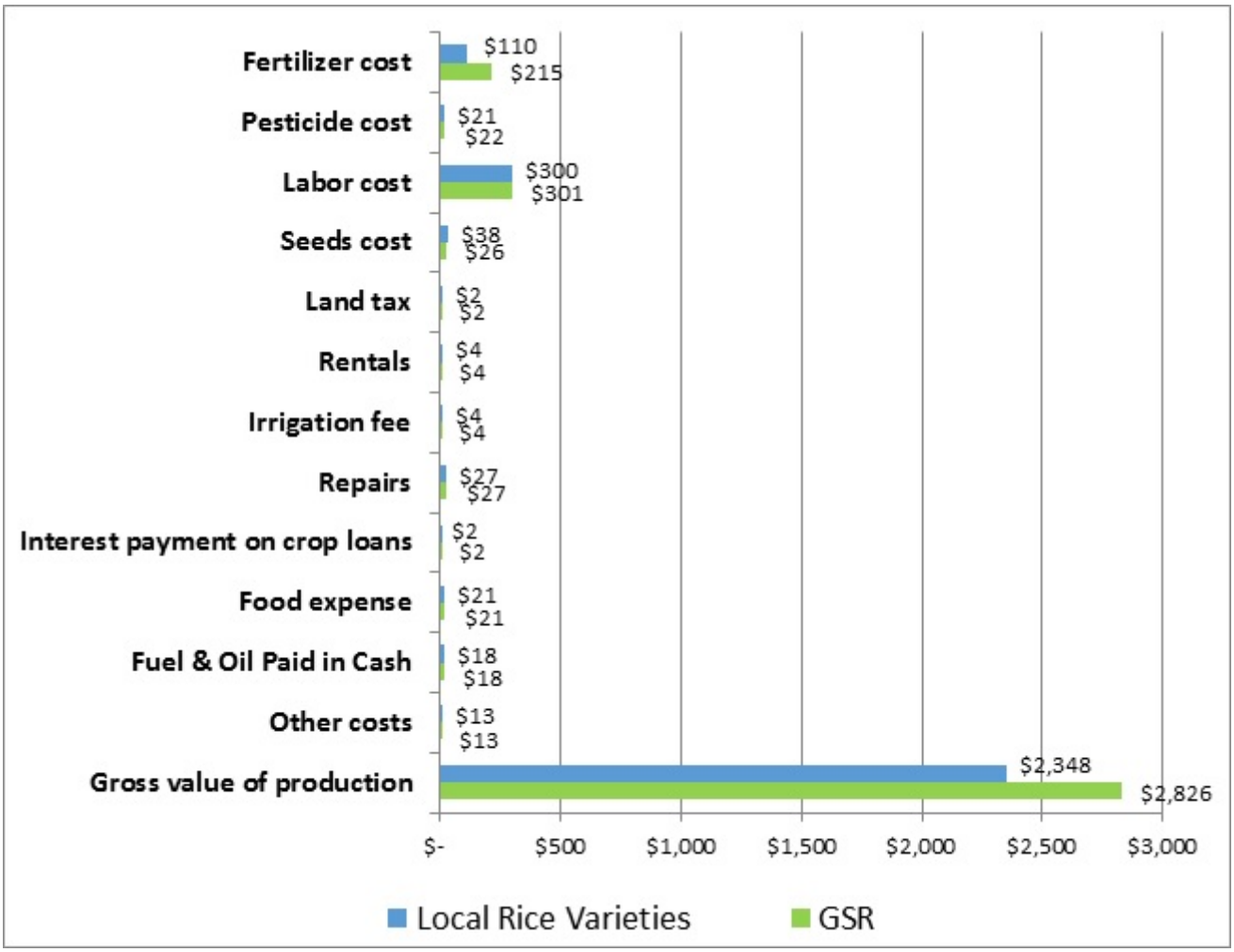
- During the dry season, the net benefit over 11 years is 53% higher in farms that adopt Green Super Rice, as compared to non-adopters. During the wet season, the net benefit of Green Super Rice adapters is 33% higher than non-adopters.
- The BCR of cultivating GSR lines is higher than that of the local practice, in both dry and wet seasons.



[12]

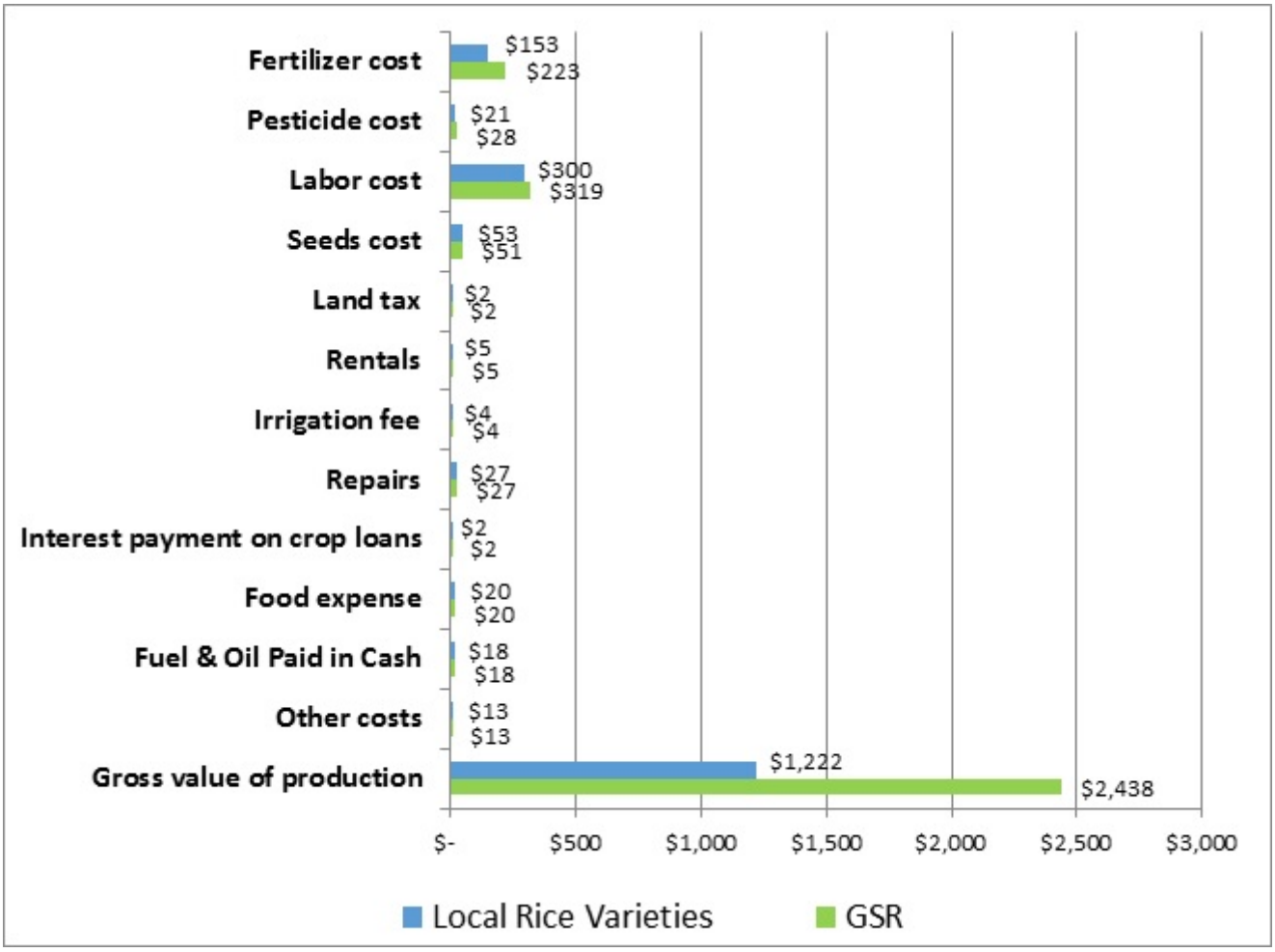
Figure 3: Cumulative Net Benefits and Benefit Cost Ratios of Good Practice and Local Practice ($ per hectare per season): ***Hazard conditions***

Figure 4 shows the average annual costs and benefits per hectare of growing GSR lines compared to the growing of local varieties under non-hazard conditions; figure 5 the same for hazard conditions.



[13]

*Figure 4: Average annual costs and benefits (US$ per hectare):**Non-Hazard conditions***
Costs are direct costs: seeds, labour, pesticide and fertilizer costs compared to gross value of production (Gross value of production = yield x average price of rice)



[14]

*Figure 5: Average annual costs and benefits (US$ per hectare):**Hazard conditions***
Costs are direct costs: seeds, labour, pesticide and fertilizer costs compared to gross value of production (Gross value of production = yield x average price of rice)

3.1 Added benefits

Under non-hazard conditions, the data reveals that the Green Super Rice brings additional net economic benefits in both dry (19% higher) and wet (58% higher) season. Therefore, it is a ?no-regret? measure in the sense that they help increase agricultural productivity regardless of the occurrence of hazards.

3.2 Avoided losses

In farms affected by dry spells during the dry season, rice production losses are reduced by 53% (about US$ 374 per ha per year). In the wet season, 33% of losses are avoided (about US$ 219 per hectare per season) in farms affected by hazards (mainly floods and pests).

3.3 Co-benefits

With the adoption of Green Super Rice and after appropriate training, the farmers use a much larger share of organic inputs than before. Consequently the use of chemical inputs is reduced, therefore reducing the environmental impact of the farming practices.

3.4 Climate Change Adaptation related benefits

Green Super Rise is more resistant to hazards such as dry spell and drought, floods and delay in the rainy

season and is therefore adapted to face unreliable rains and rainfall variability induced by climate change.

3.5 Market prices

Cost of GSR seeds was 25 USD/ha.

During the monitoring period, GSR was sold in the market at average 0.78 USD/kg while the local rice variety was sold at 0.70 USD/kg.

SOURCE(S):

FAO Strategic Objective 5 ? Resilience, in FAO [15]

Country:
Italy

The International Rice Research Institute (IRRI) [16]

Country:
Philippines

Source URL: http://teca.fao.org/technology/multi-stress-tolerant-green-super-rice-philippines-cost-benefit-analysis-based-field

Links:
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