EMBRACING HYBRID RICE:
IMPACTS AND FUTURE DIRECTIONS[1]

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Introduction

Rice continues to be the bread and butter of Philippine agriculture. It is the only single commodity, which contributes 21% of agriculture's gross value added (NSCB, 2003). Rice is the staple food of 86% of 84 million Filipinos (Castillo, 2004). The rice industry also employs more than two million farmers, thousands of traders and millers, and millions of agriculture landless workers. So vital in the lives of the Filipinos, rice becomes a very political commodity and is continuously the center of national agriculture programs.

Rice production in the country, however, grew slowly for the past two decades. Yield growth has substantially declined from an average of 3.8% per annum in 1970 to 1986 to 0.9% yearly in 1986-2001. Area expansion also contributed in production growth. From a yearly growth rate of 0.2% in 1970-1986, area harvested has grown 1.3% annually in 1986-2001 due to modest irrigation investments and increasing cropping intensity (Hossain and Narciso, 2003).

Other studies also arrived at similar results (David and Balisacan, 1995; Balisacan, 2003). From 1970 to 1980, yield grew by 5% as propelled by use of high yielding varieties. On the other hand, yield growth slackened to 2% per annum in 1980s due to stabilizing adoption of modern varieties, sharp decline in rice prices, increase in input prices, and declining flow of credit in the rice sector. Annual yield growth has further deteriorated to 1% from 1990 to 2000. This happened on the context of devolution of agricultural extension to local government, which had hampered the flow of technology from R&D institutions to farmers. Fortunately, a rebound was felt from 2000 to 2004 as yield boosted by 3% per year (Table 1).

Table 1. Growth rates (%) in paddy production, area, and yield, 1970-2004.

Item	1970-1980	1980-1990	1990-2000	2000-2004
Production	5.92	2.02	2.66	3.99
Area	0.97	-0.18	1.67	0.54
Yield	4.96	2.21	0.99	3.43

In contrast, population in the country is steadily growing at 2.36% per year. In addition, there is an increasing trend in rice per capita consumption

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growing from 95 kg per year in 1995 to 102 kg per annum in 2000. In 2004, rice per capita consumption swelled to 109 kg per ha. Given this, the demand for rice has constantly outpaced the gains in production. As a result, net importation of rice has been increasing in the recent years (Figure 1). Production also became highly dependent on weather condition, which was highlighted by El Niño phenomenon, resulting in importation of more than two million tons in 1998.

In addition, rice area declines as land conversion takes place owing to high level of urbanization and industrialization. With or without globalization, the increasing opportunity cost of land will shift away its use from rice production to more profitable endeavors. The same is true for water resources. Eventually, water will be reallocated for human consumption and industrial uses where its value is higher than its current use in agriculture.

The increasing demand of the population coupled with declining resource base rationalizes the need for a technology-based growth in agriculture specifically in rice production. The country's capability to push the yield further will determine the sustainability of rice food security in the future.

Hybrid Rice Commercialization Program

Inspired by the success story of China, the Philippine government has adopted the commercialization of hybrid rice as a flagship program. China has demonstrated to the world that hybrid rice can increase yield from 20% to 30% with the same level of inputs utilized in inbred rice varieties (Yuan, 1998). In the Philippines, early on-farm experiments showed that hybrid rice has a yield advantage of at least 15% over the inbred varieties.

The Hybrid Rice Commercialization Program (HRCP) was officially launched in December 2001 through Administrative Order 25. The HRCP aims to promote the widespread use of hybrid rice seed technology to enhance farm productivity and income. The program was initially implemented in 2002 wet season (WS).

Since then, area harvested to hybrid rice spirally increased from 6,825 hectares (ha) in 2002 dry season (DS) to 111,696 ha in 2004 WS. Hybrid rice production also remarkably increased from 46,747 tons in 2002 DS to 627,698 tons in 2004 WS. Thus, from a mere 1%, area harvested to hybrid rice rose to 7% of total irrigated area harvested in 2004 WS (Figure 2). Its contribution to total irrigated area production also increased from 2% to 10% within the same period (Figure 3). In addition, actual hybrid rice yield at the farm level averaged at 6 tons per ha (GMA Rice Program).

The program's success relied heavily on the commercial availability of hybrid seeds. To contribute in the development of a viable hybrid rice seed industry, the government initially trained organized seed growers in the seed production of public-bred hybrid varieties. The government also initially provided production support to these seed growers in the form of free seed

parentals, GA3, low volume sprayer, and technical and credit assistance. As seed growers gain technical competence, their seed yield increased from an average of 336 kg per ha in 2002 WS to 836 kg per ha in 2004 DS. Seeing the improvement in capacity of seed growers, the government gradually withdrew its production support starting 2004 DS.

The government also guaranteed the price of public-bred hybrid rice seed at P120 per kg at the outset. Hybrid seeds was procured from seed growers at this price and distributed to master-listed farmer-beneficiaries. This cost too much for the government owing to inefficiencies in seed positioning and distribution. Recognizing this, the government ended seed procurement by 2004 WS and allowed the seed growers to market their own produce.

The introduction of high value seeds like hybrid rice at low seeding rates is expected to meet unenthusiastic adoption response. This is due to farmers' practice of using home-saved or exchanged seeds and high seeding rates. Thus, the government subsidized the cost of seeds to farmers to induce adoption. Table 2 shows the progress of HRCP policies on seed subsidy.

Table 2. Progress on Hybrid Seed Subsidy Policy.

SEASON	SEED SUBSIDY	FARMER'S SHARE
2002 WS – 2004 WS	P 60 per kg	P 60 per kg in publicly-bred varieties
2003 DS – Present	*Plant now pay later* scheme	**Difficulty in collection*
2005 DS	P 87.50 per kg for publicly bred varieties and P 60 per kg for privately bred varieties	P 32.50 per kg of publicly bred varieties
2005 WS	P 65 per kg for publicly bred varieties and P 60 per kg for privately bred varieties	P 55 per kg of publicly bred varieties

Other private companies were also encouraged to enter the hybrid rice seed business. Some of the active private hybrid rice companies are Bayer, SL Agritech, and HyRice corporations. The government allowed these companies to set market price for their own hybrid rice. Hence, they sell their own private-bred hybrid varieties and shoulder the marketing cost. Opportunely, they are allowed to collect from the government the amount of seed subsidy given to farmers for every kilogram of hybrid seeds they sold to farmers. Currently, the share of private seed companies in total seed production area amounts to 18% while that of seed grower cooperatives sums to 76% (Masajo and dela Rosa, 2005).

Impact Assessment Studies

The Philippine Rice Research Institute in collaboration with the STRIVE Foundation conducted a study on *Midterm Impact Assessment of Hybrid Rice Technology in the Philippines*. In this study, farm level survey from 2002 WS to 2004 DS. The survey covered five major hybrid rice-producing provinces, which includes Isabela, Nueva Ecija, Iloilo, Davao del Sur, and Davao del Norte. Using stratified random sampling, five categories of farmers were interviewed namely: 1) farmers who use public hybrids; 2) farmers who use private hybrids; 3) farmers who use certified seeds availed from government; 4) farmers who use certified seeds directly availed from seed growers; and 5) farmers who used home-saved seeds or exchanged with co-farmers. A total of 1796 samples (991 inbred and 805 hybrid users) were interviewed (Gonzales and Bordey, 2005).

The Socioeconomics Division of PhilRice also did a follow up study on the social impacts of hybrid rice technology on farmers who continuously use it. The study focused in Isabela, due to presence of a critical mass of farmers who use hybrid rice technology for at least two seasons. These farmers were categorized as hybrid rice adoptors. A total of 30 hybrid rice adoptors were interviewed on the perceived impacts of hybrid rice on them as individual, on their household, and on their community. About 30 inbred farmers, who have no experience in using hybrid rice technology, were also interviewed and categorized as the control group (Relado, et al, 2005).

Impact on Farm Productivity

Table 3 shows that average yield advantage of hybrid rice production over the inbred ranges from 8% to 14% during the four-season period. Yield distribution (Figure 5) during 2002 WS reveals that about 47% of hybrid rice respondents attained yield of 5 tons per ha and above while only 38% of inbred rice respondents achieved the same. However, in the same season, more hybrid rice respondents also achieved yield of 3 tons per ha and below (21% of hybrid respondents vs. 17% of inbred respondents). This shows that while getting higher yield is more plausible when using hybrid rice, there are still some farmers who did not maximize its use, which can be attributed to improper crop management practices.

Figure 4 also shows the hybrid and inbred rice yield distributions in 2004 DS. In the fourth season, 57% of hybrid rice farmers got yield of more than 5 tons per ha compared to 44% of inbred rice farmers who achieved such. In addition, percent of hybrid rice farmers with yields of 3 tons per ha and below decreased to 5% compared to 12% of inbred respondents. This implies that hybrid rice yield tends to improve as farmers get used to the technology.

Season	Inbred	Hybrid	% Difference
2002 WS	4.59	5.12	12% **
2003 DS	5.02	5.73	14% ***
2003 WS	5.08	5.50	8% ***
2004 DS	4.83	5.34	11% ***

*,**, and *** indicate the significance at 1%, 5%, and 10% level, respectively.

Table 3. Average yield of inbred and hybrid rice (mt/ha), by season.

Table 4 shows the results of production function analyses using data for dry season, wet season, and combination of both. Results reveal that holding other factors constant, the hybrid rice technology significantly increases the yield by 8%. Translating this in terms of kilograms, hybrid rice net yield advantage over the inbred is around 400 kilograms per ha. The outcome of the regression analyses shows that yield advantage is indeed more recognizable during dry season. Other factors that significantly affect the yield are nitrogen and pesticides application, and labor.

Table 4. Results of production function estimation.

Explanatory Variables	Coefficient		
	Dry Season	Wet Season	All Season
Constant	8.16 ***	7.94 ***	8.00 ***
Ln seed	0.03	-0.01	0.01
Ln nitrogen	0.02 **	0.02 **	0.02 ***
Ln chemical active ingredient	0.00	0.01 **	0.01 *
Ln labor	0.02	0.10 ***	0.07 ***
Hybrid dummy	0.15 ***	0.01	0.08 **
Season dummy			0.05 ***
R-squared	0.04	0.03	0.03
F-Statistics	8.16 ***	5.09	9.86 ***

*,**, and *** indicate the significance at 1%, 5%, and 10% level, respectively.

Impact on Farm Income

Aside from the yield advantage, the four-season survey also shows that hybrid rice has a price advantage over the inbred by about 30 centavos per kg (Table 5). This suggests that hybrid rice has better or at least the same eating quality as the inbred rice. This case is unique in the Philippines as experience in other countries showed lower price of hybrid rice due to poor eating quality (Hossain, 2005). The yield and price advantage translate to higher gross income from hybrid rice cultivation. On the average, the gross income advantage of hybrid rice production over the inbred ranged from 15 to 19%.

Table 5. Average price of inbred and hybrid rice, by season.

Season	Inbred	Hybrid	Difference
2002 WS	7.95	8.26	0.31 **
2003 DS	7.99	8.32	0.33 ***
2003 WS	7.81	7.83	0.02 ***
2004 DS	8.64	9.00	0.36 ***

Hybrid rice production cost per ha also increased owing to higher seed, fertilizer, pesticide, and labor costs. The latter is higher for hybrid rice production due to larger crop establishment, harvesting, and threshing costs. Initially in 2002 WS, the incremental production cost per ha when using hybrid rice is 13%. This was streamlined to 5% in 2004 DS as farmers gained more experience in planting hybrid rice and thereby increased their cost efficiency. The distribution of cost per kg showed that more hybrid rice farmers are actually getting lower cost per kg than inbred rice farmers. However, in 2002 WS there are some hybrid rice respondents who are very cost-inefficient that pulled up the average unit cost. As farmers gained experience in hybrid rice production, less hybrid farmers incurred higher cost per kg than their inbred counterparts (Figure 5).

Figure 6 shows the net income distribution of hybrid and inbred rice farmers. On the average, hybrid rice income is 23% higher than that of inbred. Similar to trends in yield distribution, the income advantage of hybrid rice is more pronounced during dry season. More hybrid farmers are also getting income higher than PhP 20,000 per hectare compared to inbred respondents despite the higher hybrid rice production cost per hectare.

The incremental rate of return also shows that the additional farm investments in using hybrid rice are worthwhile. From 88% in 2002 WS incremental rate of return on additional hybrid rice investments increased to 393% in 2004 DS. Even if the price of seeds were not subsidized, the incremental rate of return was still substantial at 26% in 2002 WS. This improved further to 133% in 2004 DS (Casiwan, et al, 2005).

Impact on Farm Practices

The dynamic process of hybrid rice adoption suggested that farmers follow a sequential process of adopting several interrelated technologies. This theory in interaction of several adoption decisions was already implied in studies by Nerlove and Press (1973, 1976) and Feder, et al (1985).

The promotion of hybrid rice simultaneously created greater awareness on the other component technologies in rice production that have been ignored in the past. The novelty of hybrid rice and the relatively costlier seed made rice farmers become more careful and diligent in applying the new technology. They are now interested in optimizing hybrid rice production, at less cost.

One of the significant impacts is on the seeding rate. Farmers are fast learning that 20-25 kg seeds are enough to plant 1-hectare transplanted rice, where they used to consume between 80 and 120 kg of inbred seeds per ha. Many farmers are now also using hybrid rice seeds at a very much lower rate (25-40 kg per hectare) for direct seeding, where they used to broadcast between 120 and 200 kg per hectare using ordinary inbred seeds.

Aside from the lower seeding rate, farmers now also adopt synchronous planting; the use of 400 sq m seedbeds; straight row planting; and organic fertilizers. Where farmers used to apply only 10 to 90 kg organic fertilizer in inbred rice, they now use 50 to 200 kg organic fertilizer in hybrid rice.

During the early years of implementing the HRCP, hybrid rice farmers tended to excessively apply inorganic fertilizers and chemicals. As they are now mastering the nuances of the hybrid rice technology, their inorganic fertilizer application and chemical pesticide usage are likely to be the same with inbred farmers.

In the wet season of 2002, 37% of farmers signified their intentions to use hybrid technologies in inbred rice production. In the dry season of 2003, this grew to 38%; and in the wet season of the same year, it jumped to 55%. This shows that with the growing mastery of hybrid rice technologies, farmers are now willing to use their "hybrid-inspired" technologies and practices in inbred rice production. The promotion of hybrid rice therefore benefits farmers not only in terms of higher productivity owing to better seeds, but also in terms of better production and post production technologies, which also have a spill over effects on their rice farm management methods.

Impact on the Rice Economy

The estimated financial and economic benefit-cost ratios of the HRCP are 1.56 and 1.13, respectively, from 2002 to 2009. This implies that the financial and economic benefits from the program outweigh its program costs. The net present value analysis also showed that the financial NPV of the HRCP is worth PhP 1.4 billion while its economic NPV amounts to PhP 314 million, also for the period 2002 to 2009. In addition, the HRCP also led to foreign exchange savings equivalent to US$ 23.25 million during the period 2002 to 2004.

Social Impacts of Hybrid Rice

Results of the social impact study showed that 100% of hybrid rice adoptors in Isabela considered themselves as better provider as their rice income increased by 20%. In comparison, only 60% of inbred farmers professed satisfaction as income provider. In addition, about 90% of the hybrid rice respondents also declared significant gain in skills and techniques specifically on seedbed preparation and seedling management. This gave them higher level of confidence in discussing rice issue with their peers.

Furthermore, all hybrid rice adoptors claimed fulfillment of being hybrid farmers compared to 77% of their inbred counterparts.

It was also interesting to note that hybrid rice respondents claimed to have acquired more assets after continuous planting of hybrid rice compared with inbred rice respondents. The popular appliances that are obtained from the proceeds of hybrid rice farming are cellular phones, colored television, refrigerators and washing machines. About 60% of hybrid rice adoptors stated that they could not buy such assets if not for planting hybrid rice. In contrast, though inbred rice farmers could also buy appliances, they stressed that they could not do so with income from rice farming alone.

All inbred rice respondents told that farmers in their community want to try hybrid rice technology because of its higher yield. However, according to 60% hybrid rice respondents, farmers in their community are discouraged to try it because of additional labor requirement. They argued, though, that except for seedbed preparation and seedling management, crop management for hybrid does not differ with that of inbred (Relado, et al, 2005).

Future Directions

The active role of the government paved the way to initial process of diffusion of hybrid rice technology. However, the implementation of HRCP must be further improved to optimize the gains from hybrid rice. Given the government's financial crisis, efficiency in program implementation is very crucial. Currently, the amount of budgetary support given by the government limits the supply of seeds and thereby constrains the diffusion of hybrid rice technology. This implies that the government role in the commercialization of the technology must be reviewed.

A private sector-led hybrid rice commercialization is envisioned in the future. The private sector must play a greater role in the commercialization of hybrid rice technology. The government must now concentrate in making the policy environment conducive for the private sector to do its business. To make this happen, a leveled playing field for the business must be established.

The recently held Third National Workshop on Hybrid Rice outlined several policy recommendations that will ensure a more sustainable hybrid rice commercialization and adoption. These recommendations are summarized below.

Free market for hybrid rice seeds. The government shall end its involvement in hybrid seed procurement, marketing, and distribution. The private seed companies and seed grower cooperatives shall now be active in marketing of their seed produce. Furthermore, the government will now allow the market forces to determine the price of both public and private-bred hybrid seeds.

Phasing-out of seed subsidy by 2007. Seed subsidy to farmers will be reduced to P55 per kg in 2006 WS. By 2007 WS, the full cost of seeds shall be borne by the farmers. However, this is anchored in the assumption that significant improvements in farm yields and self-sufficiency is sustained. As already pointed out in the analysis of incremental rate of returns, even without the subsidy, farmers will still get a reasonable return on their additional investments on hybrid rice.

Self-regulation and truthful labeling for seed quality. To ensure seed quality, self-regulation and truthful labeling shall be promoted. The NSQCS shall accredit private and other public laboratories to do seed testing for private seed companies and seed growers. They shall be encouraged to set-up their own quality control measures. An enforceable penalty system for violators of truthful labeling shall be designed.

Building the local capacity to produce seeds. Seed importation shall be temporarily allowed for only two years while the seed company is building up its capability to locally produce seeds. Seeds that will be imported are the hybrid varieties released by the National Seed Industry Council and subjected to National Cooperative Testing. Seed importation shall also be subjected to current policies on quarantine and phytosanitary measures. In the future, seed companies shall seriously consider the phytosanitary requirements in other countries for possible exports of hybrid seeds.

Public-private partnership in hybrid rice variety development. Efforts at encouraging the participation of private seed companies shall continue, not only in hybrid rice seed production and marketing, but also in R&D activities for the development of new hybrids. A mechanism for sharing publicly bred hybrids should be developed in a way that revenues may be shared between institutions and companies or scientists.

Strengthening of seed cooperatives to handle public hybrids. Technical support, training, and assistance to smaller hybrid rice seed grower cooperatives shall be sustained to further improve their efficiency in seed production. Their capacity to produce quality seeds shall also be enhanced by encouraging them to invest on storage, processing, and quality control facilities. Linking their organization to credit sources will enable them to avail of the said facilities such as seed cleaners, seed dryers, and seed storage. Their market niche within their region or zones shall be strengthened before the subsidy is phased-out in 2007. The marketing capacity of seed cooperative shall be boosted through entrepreneurship trainings. In the future, strong seed cooperatives may bid to get exclusive license to distribute publicly bred hybrids.

Focused role of the national government. The government shall continue to fund and implement basic research on parental lines. They shall continue to develop better inbred varieties, which are necessary in the development of better hybrids. This is one way to reduce the hybrid seed cost because the cost of doing upstream research is borne by the government. Along with this,

they will also continue efforts in hybrid rice variety development, and regularly conduct trainings on seed production of public-bred hybrids.

In addition, on-farm adaptive research for location specific crop management technologies for hybrid cultivation and seed production must be continuously pursued in collaboration with State Colleges and Universities (SCUs), the regional research centers (RIARCs) of the Department of Agriculture, and capable local government units (LGUs). These agencies will also be tapped to provide technical expertise and training assistance to extension workers to ensure that the hybrid rice yield advantage is achieved in their specific regions.

Improved implementation of rice program. In the medium term, the private and public sector will continue to collaborate in a public sector-led rice program. The new rice program of the national government will not only focus in dissemination of seed technology but also in the promotion of an integrated crop management system. The national government particularly the Department of Agriculture shall focus on coordinating and facilitating roles while LGUs shall be given leeway to plan and implement their own local rice program using the framework of clustering approach. A cluster is a group of 100 ha within one-kilometer radius. These clusters shall be established in irrigation turnouts, which shall serve as production units.

Through focus on target cluster areas, technical supervision on hybrid rice farmers will be maximized. In addition, the program support for each cluster such as assured availability of irrigation water, soil analysis, and training could complement the hybrid seed technology. The private sector shall also be encouraged to provide allied services such as custom hiring of farm machinery, postharvest facility, credit, and market system.

The new rice program will focus production interventions in 37 major rice-producing provinces all over the country. One of the program's targets is to establish 2,000 clusters by 2006, which will be increased to 2,225 by 2007. These clusters will be involved in hybrid rice production. The program aims to achieve average hybrid rice yield of 6.75 tons per ha and 6.50 tons per ha for DS and WS, respectively. The program goal is to achieve a total palay production of 15.88 million tons in 2006 and 16.67 million tons in 2007.

Summary and conclusion

Hybrid rice production is one of the best options to increase farm productivity and income among the technologies available today. On-farm data shows that it can increase yield from 8 to 14% or at least 400 kg per ha when production function results were considered. Yield distribution also shows that there are more hybrid rice farmers achieving 5 tons per ha and above than inbred rice farmers.

Hybrid rice has also price advantage of around 30 centavos per kg over the inbred rice. This shows a good market acceptability of milled hybrid rice due to its good eating quality. This phenomenon is unique in the Philippines as price of hybrid rice in other countries are usually discounted because of poor eating quality.

The combined yield and price advantage of hybrid rice are the source of income growth among hybrid rice farmers. Though production cost increased due to higher seed, fertilizer, and pesticide and labor costs, difference in cost per unit between hybrid and inbred rice production has narrowed as hybrid farmers become more familiar with the technology. As a result, the rate of return on additional peso investment of hybrid rice farmers is very remarkable at 88% in 2002 WS, which further increased to 393% in 2004 DS. Considering the real price for hybrid seeds and imputing it in the cost of production, hybrid rice production still demonstrate a substantial rate of return in additional peso investment, which is 26% in 2002 WS and 133% in 2004 DS.

Aside from impacts on farm productivity and income, hybrid rice promotion also created sequential adoption of other component technologies in rice production that have been ignored in the past. For one, farmers are fast-learning that 20 to 25 kg of seeds are enough to plant a hectare using transplanted method of crop establishment. Farmers used to broadcast 80 to 120 kg of inbred seeds per ha. In addition, farmers now also adopt synchronous planting, use of 400 sq m seedbeds, straight, and row planting. Hybrid rice use also encouraged farmers to use organic fertilizers specifically in the seedbeds.

On the national scale, government investments on the hybrid rice commercialization have incurred financial and economic benefit-cost ratios of 1.56 and 1.13, respectively. These suggest that society's benefits from hybrid rice have outweighed the costs of the program. The estimated dollar savings from rice importation resulting from hybrid rice commercialization amounts to US$ 23.25 million.

On the social side, hybrid rice adoptors professed improvement in their livelihood as a result of planting hybrid rice. They claimed that they become better provider and were able to buy new appliances for their households. In addition, they signified improvement in their confidence as rice farmers.

According to the inbred rice respondents, farmers in the community are willing to try hybrid rice technology but the perceived laborious process of planting hybrid rice discourages them. Hybrid rice respondents, on the other hand, argued that except for seedbed preparation and seedling management, managing hybrids did not differ with inbred rice.

These benefits at the farm level have established a considerable demand for hybrid rice seeds. Though the government had played a big role in the initial diffusion process of hybrid rice technology, a greater role of the private sector in its commercialization is now warranted. To make this happen, a leveled playing field for the hybrid seed business must be created.

Among the policy actions to create an environment conducive for seed business are outlined as follows:

1) Free market for hybrid seeds;
2) Phasing-out of seed subsidy by 2007 WS;
3) Promotion of self-regulation and truthful labeling;
4) Building the local capacity to produce hybrid seeds by allowing importation in a temporary manner subject to existing quarantine and phytosanitary regulations;
5) Public-private partnership in development of hybrid varieties;
6) Strengthening seed grower cooperatives to handle public hybrids; and
7) Focused role of the public sector in R&D, training, and extension.

In the medium term, the private and public sector will continue to collaborate in a public sector-led rice program. In the new rice program, the Department of Agriculture will focus on coordinative and facilitative roles while Local Government Units will have more leeway in planning and implementing their own local rice program using the framework of clustering approach. Through clustering, the targets of the program will be well defined, and there will be a systematic mechanism of delivering technology and services to farmers.

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Figure 1. Rice net-imports in the Philippines

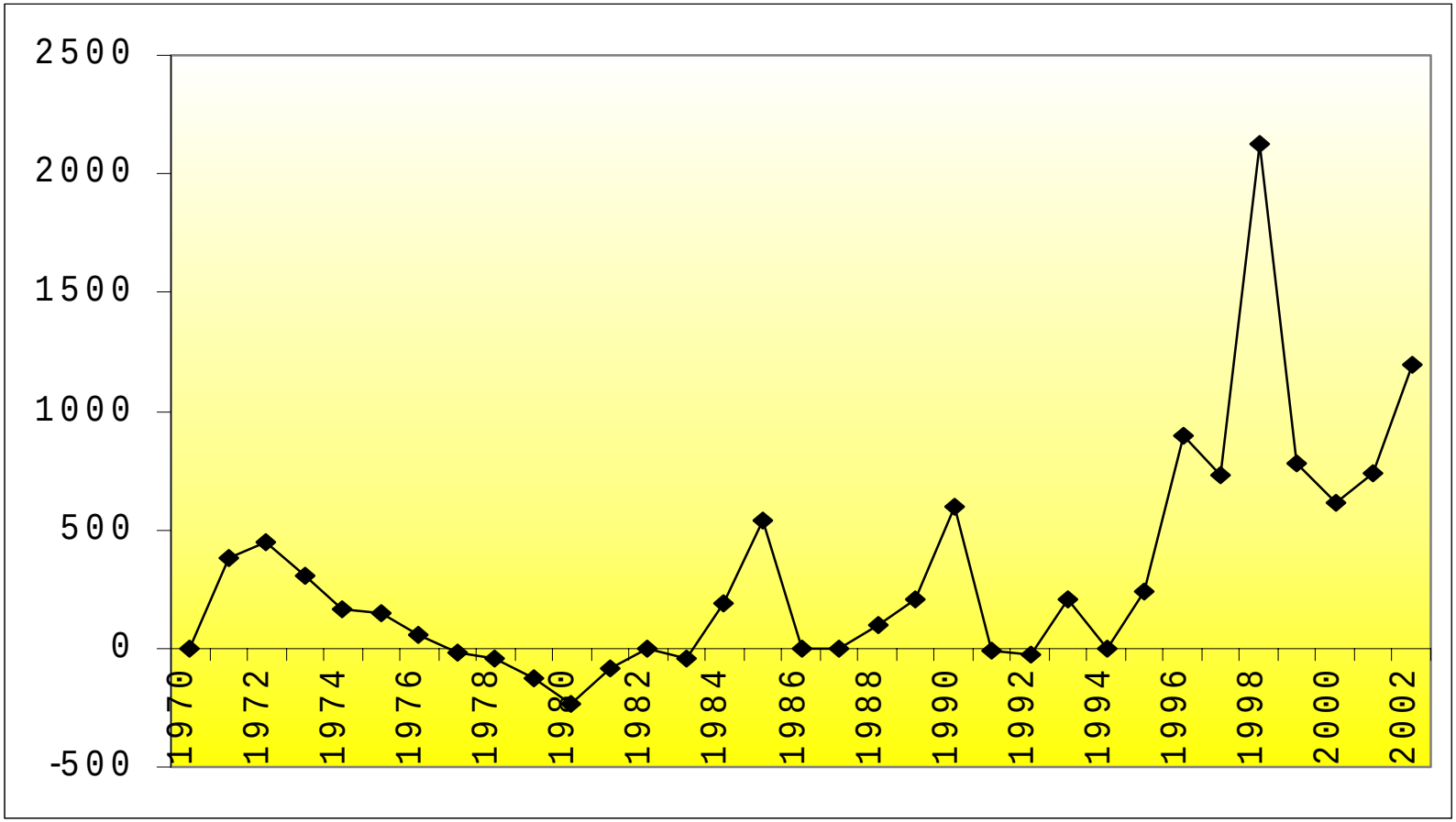


Figure 2. Area Harvested to Hybrid Rice and Percentage to Total Irrigated Area Harvested

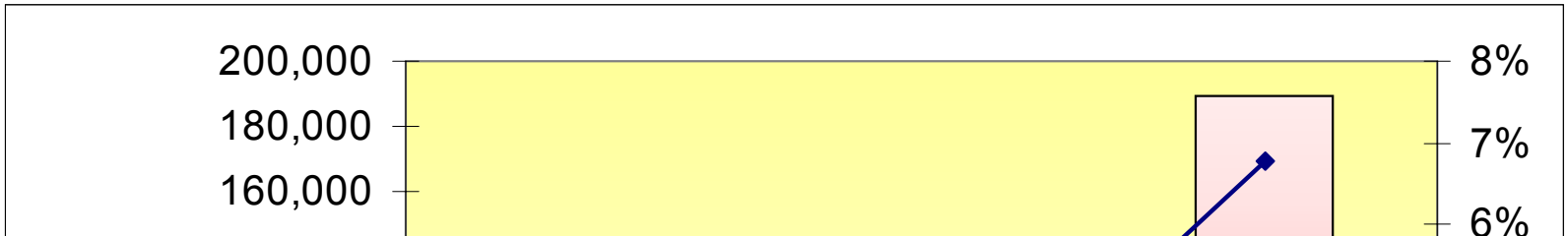
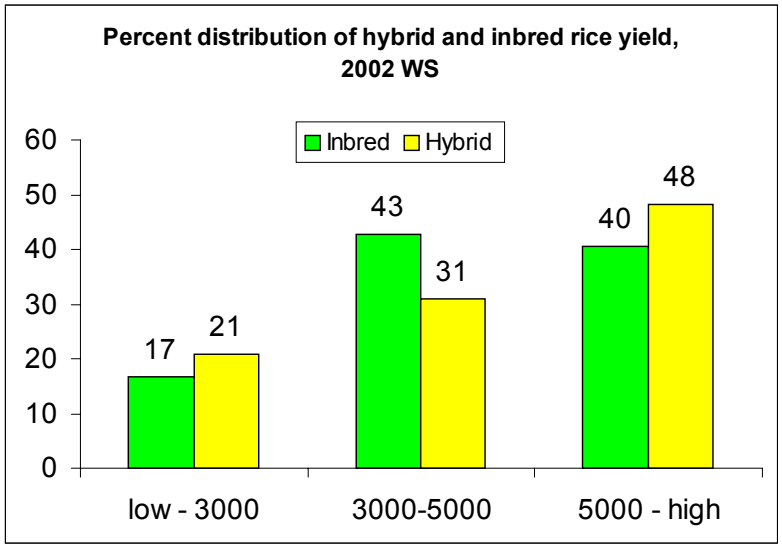
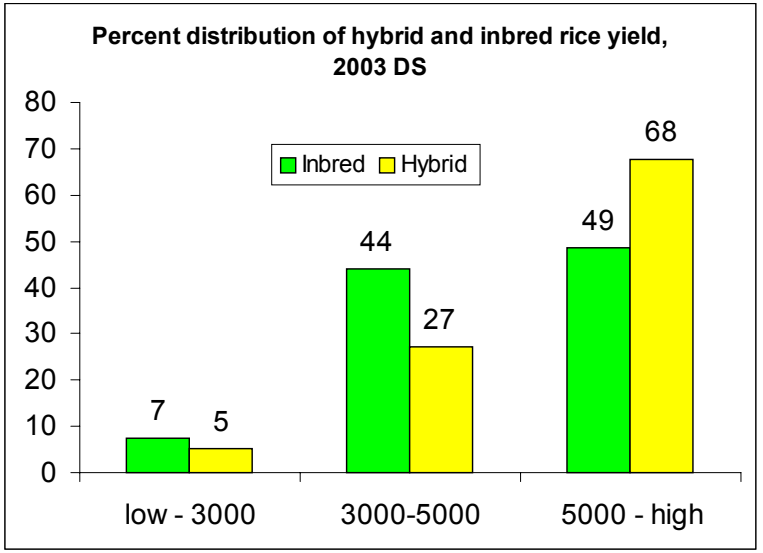
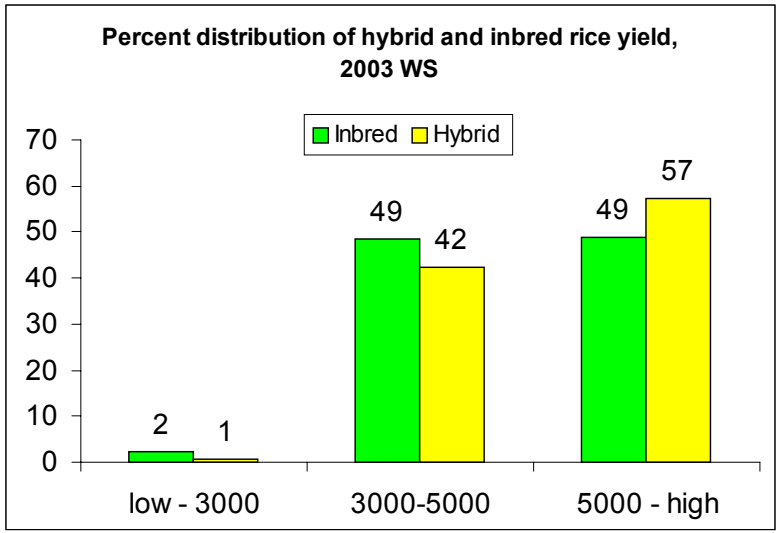


Figure 3. Hybrid Rice Production and Percentage to Total Irrigated Area Production

Figure 4. Inbred and Hybrid Rice Yield Distribution, 2002 WS-2004 DS







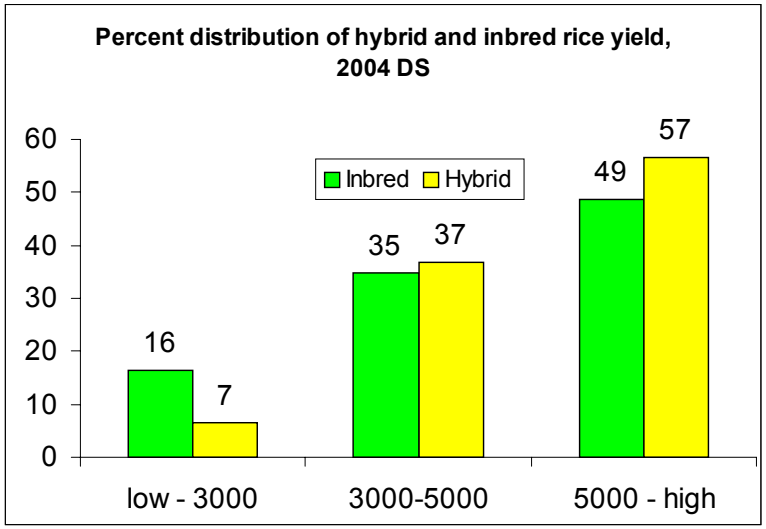
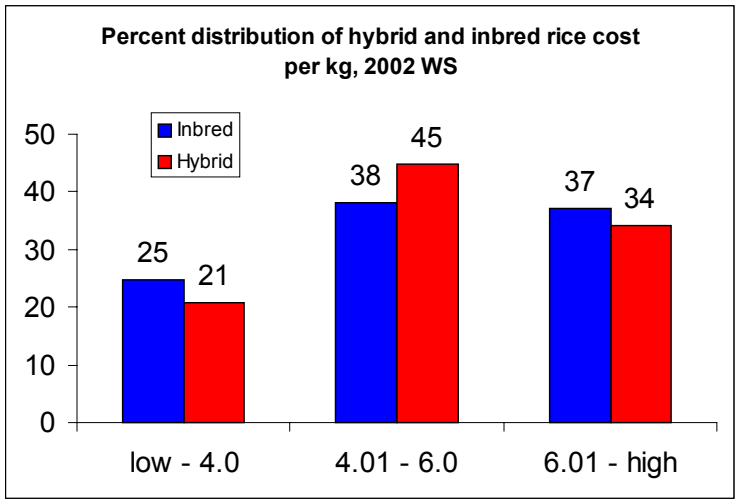
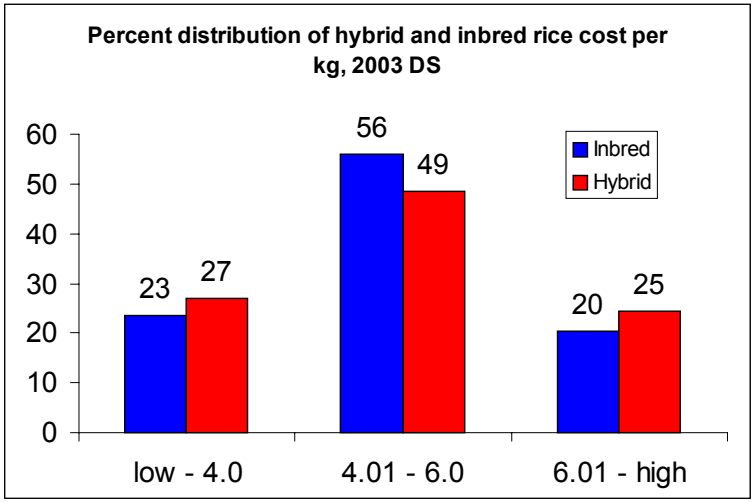
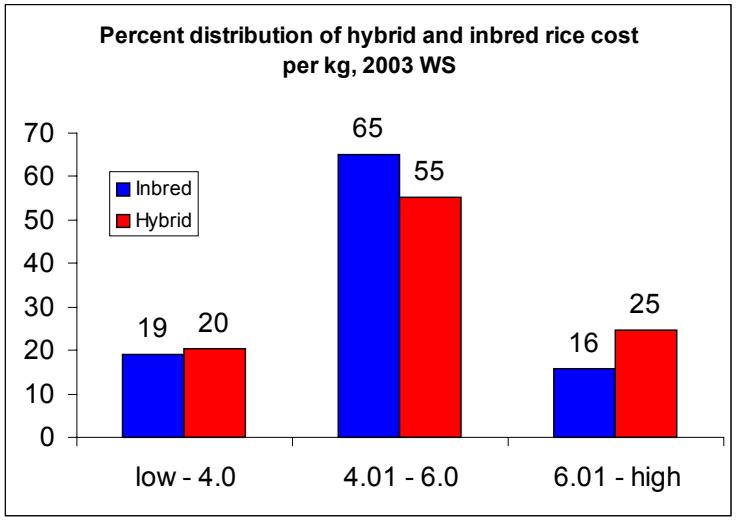


Figure 5. Inbred and Hybrid Rice Unit Cost Distribution, 2002 WS-2004 DS







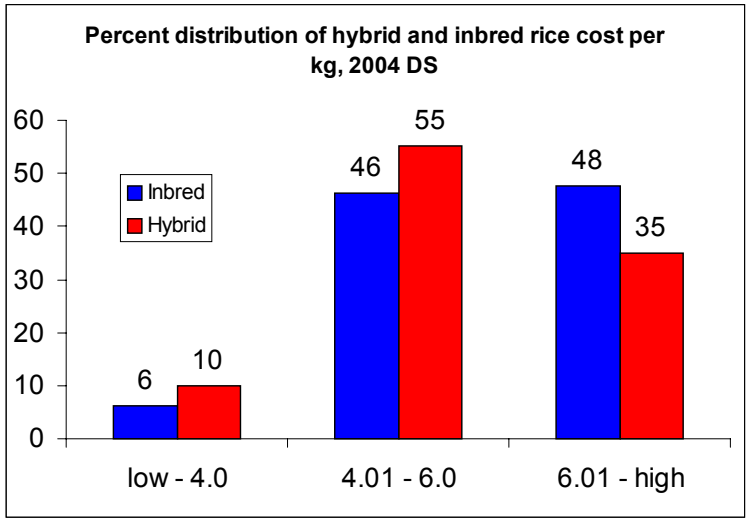


Figure 6. Inbred and Hybrid Rice Net Income Distribution, 2002 WS-2004 DS