Promoting Implementation of crop Diversification in Rice-based Irrigation Systems in the Philippines

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INTRODUCTION

THE PHILIPPINES IS basically an agricultural country with 70 percent of the population living in the countryside and depending on agriculture and agriculture-related activities for their livelihood. Agricultural production, however, is traditionally concentrated on a few main crops. Rice and corn are the major food crops while coconut and sugarcane are the major commercial crops which constitute the important export commodities.

Rice contributes a substantial portion of the country's gross national produce, accounting for an average of 15.19 percent of the total value of the nation's agricultural production in the last nine years. Production grew at an average of 2.8 percent per annum from 1970 to 1990. From 1981 to 1990, a mean total production of 8.57 million metric tons per year was achieved (Table 1). In 1991, this output is expected to increase to 9.8 million metric tons with the implementation of the Rice Action Program (RAP).

Of the more than three million hectares (ha) of potentially irrigable arable lands of the Philippines, 48 percent or 1.5 million hectares are already provided with irrigation facilities as of the end of December 1990 (Table 2). The national (government-managed) irrigation systems

Table 1. Rice production, area harvested and yield, the Philippines, 1970-90.

Year	Production (Million tons)	Area harvested (Million ha)	Yield (t/ha)
1970	5.32	3.11	1.71
1971	5.26	3.25	1.62
1972	5.11	3.39	1.51
1973	5.39	3.38	1.60
1974	5.55	3.52	1.58
1975	6.38	3.63	1.76
1976	6.54	3.65	1.79
1977	7.26	3.70	1.96
1978	7.22	3.55	2.03
1979	7.69	3.54	2.17
1980	7.65	3.47	2.20
1981	7.91	3.42	2.31
1982	8.33	3.35	2.49
1983	7.30	3.06	2.39
1984	7.83	3.16	2.48
1985	8.81	3.31	2.66
1986	9.25	3.47	2.67
1987	8.54	3.26	2.62
1988	8.97	3.39	2.64
1989	9.46	3.50	2.70
1990	9.32	3.32	2.81

Source of basic data: Bureau of Agricultural Statistics.

(NISs) cover 0.634 million hectares while the communal (farmer association-managed) irrigation systems (CISs) encompass 0.715 million hectares.

The other 52 percent of the total irrigable area is targeted for full irrigation development within the decade ending in the year 2,000. This is embodied in the Republic Act 6978, an act promoting rural development by providing an accelerated program within a ten-year period for the construction of irrigation projects.

Mean cropping intensity from 1979 to 1989 in the NISs was only about 134 percent per year, i.e., 74 percent during the wet season and 60 percent during the dry season (Table 3). The area programmed is less than the total service area even during the wet season. During the dry season, this is even less, primarily due to inadequate water supply particularly in the direct diversion type systems.

Table 2. Status of irrigation development as of end of December 1990, the Philippines.

Region	Total land area ha)	Potential irrigable area (ha)	Irrigation service area (ha)				Irrigation development (%)
			National systems	Communal systems	Private systems	Total	
1	2,156,800	309,764	45,386	133,604	5,520	184,510	59.56
2	3,620,400	539,709	153,107	85,986	36,593	275,686	51.08
3	1,827,800	482,215	172,064	85,690	22,946	280,700	58.21
4	4,751,400	263,593	55,455	72,332	27,948	155,735	59.08
5	1,763,300	239,646	16,209	51,392	16,943	84,544	35.28
6	2,022,300	197,251	53,500	34,191	21,677	109,368	55.45
7	1,495,100	50,739	0	19,382	2,481	21,863	43.09
8	2,143,300	84,381	15,633	38,841	2,176	56,650	67.14
9	1,868,500	76,498	13,348	21,587	2,804	37,739	49.33
10	2,855,900	230,148	22,732	46,158	2,045	70,935	30.82
11	3,158,000	290,276	48,876	63,589	6,872	119,337	41.11
12	2,340,600	362,077	37,610	62,062	4,123	103,795	28.67
Total	30,003,400	3,126,297	633,920	714,814	152,128	1,500,862	48.00

Source: CORPLAN, National Irrigation Administration.

Table 3. Service areas, irrigated areas and irrigated cropping intensity in national irrigation systems, the Philippines, 1979-89.

Year	Service area (ha)	Irrigated area					Irrigated cropping intensity (%)
		Wet season (ha)	Dry season (ha)	Total	% of service area		
					Wet season	Dry season	
1979	475,174	372,232	285,845	658,077	78.34	60.16	138.49
1980	472,182	374,349	293,472	667,821	79.28	62.15	141.43
1981	491,729	372,038	300,416	672,454	75.66	61.09	136.75
1982	514,334	390,342	320,463	710,805	75.89	62.31	138.20
1983	549,930	362,340	293,329	655,669	65.89	53.34	119.23
1984	548,345	416,824	290,851	707,675	76.01	53.04	129.06
1985	568,203	430,888	349,424	780,312	75.83	61.50	137.33
1986	595,902	438,237	381,914	820,151	73.54	64.09	137.63
1987	596,953	433,151	370,351	803,502	72.56	62.04	134.60
1988	614,164	445,287	342,786	788,073	72.50	55.81	128.32
1989	621,144	461,613	389,562	851,175	74.32	62.72	137.03
Average	549,824	408,845	328,947	737,792	74.53	59.84	134.37

CROP DIVERSIFICATION IN RICE-BASED SYSTEMS

Crop diversification may provide a means by which farm income can be increased, given resource constraints such as those of land and water. It has the effect of reducing the risk in crop production caused by fluctuations in market-related variables. Diversification is also a step towards market-oriented production, which means that the farmer will not only be producing for his family's consumption but for the market as well. There is thus an increased effort in making the farmer realize that the level of income that will be derived from his small farmholding is of utmost consideration in making decisions on the type of farming systems he will adopt.

Crop diversification in rice-based systems is not really new in the Philippines. Technologies have been developed in line with the production of nonrice crops as alternatives to rice, particularly for the rain-fed cropping systems. With the anticipated self-sufficiency in rice coupled with the uncertain dry season water supply, the production of nonrice crops offers some opportunities for increased agricultural productivity of the irrigated ricelands.

Rice-Based Areas for Crop Diversification

The Bureau of Soils and Water Management (BSWM) has indicated that some 1.785 million ha in rice-based areas are suitable for crop diversification (Table 4). These areas are planted to upland and lowland rice, either rain-fed or irrigated.

In existing Philippine irrigation systems, there are areas suitable for upland crop production. These areas are marginal for rice production due to their lighter soil texture. These areas are commonly found in the fringes of irrigation systems and, in some cases, even dominate the major portions of the service area. In the national irrigation systems (NISs), there are approximately 207,000 ha of irrigated lands suitable for nonrice crop production (Table 5). These areas are found in regions where the rainfall could not sustain rice production during the dry season.

The traditionally water-deprived, uncultivated sections of irrigation service areas during the dry season which account for about 40 percent (253,568 ha) of the total net service area of the NISs are the most attractive targets for crop diversification. Considering soil, topography and drainage characteristics, about 30 percent (76,070 ha) of these water-deprived areas have been identified as suited to nonrice field crop cultivation.

Diversification in Irrigated Rice-Based Systems

Except for an irrigation system in the southern Philippines, there is no deliberate planning or programming of nonrice crop cultivation in most irrigation systems. However. in some irrigation systems, many enterprising farmers have traditionally been growing upland crops following irrigated lowland rice. Onion, pepper, eggplant, tomato, turnip, corn and garlic are grown in Ilocos Norte and Nueva Ecija. Cotton, tobacco, and mungbean are dominant in Pangasinan, while cotton and corn are grown in south Cotabato. Monitoring of the area cultivated to nonrice crops in irrigation service areas is not yet a regular function or activity of the NIA nor of any other agency. Nevertheless, a recent inquiry from the NIA's field offices revealed that 2.02 percent (12,808 ha) of the 633,920-hectare area isolate of the NISs was cultivated to nonrice crops during the 1989-

90 dry season (Table 6). In the 1990-91 dry season, this was only 1.45 percent. No similar data are available from the CISs, but the same percentage may likely exist.

Table 4. Rice-based cropping system development in the Philippines, 1990.

Region	Area for crop intensification (ha)	Area for crop diversification (ha)	Total (ha)
1	13,460	257,665	271,125
2	180,150	243,400	423,550
3	116,500	422,000	538,500
4	100	314,272	314,372
5	7,475	159,450	166,925
6	172,000	81,900	253,900
7	23,976	37,482	61,458
8	169,760	3,007	172,767
9	50,807	56,079	106,886
10	45,425	38,615	84,040
11	107,192	59,476	166,668
12	150,794	75,796	226,590
CAR	88,575	36,100	124,675
Total	1,126,214	1,785,242	2,911,456

Source: Bureau of Soils and Water Management, 1990.

Table 5. Dual and diversified croplands in the Philippine national irrigation systems (NISs), 1988.

Region	Service areas of NISs (ha)	Dual and diversified croplands (ha)*	Percent of service area
1	46,082	32,965	71.5
2	140,962	30,110	21.4
3	175,285	60,770	34.9
4	54,238	27,296	50.3
5	16,466	4,264	25.9
6	53,461	7,678	14.4
7	none	-	-
8	16,860	none	-
9	12,449	none	-
10	20,013	6,820	34.1
11	34,711	24,291	69.9
12	27,426	13,768	50.2
Total	597,953	207,962	34.8

* Dual and diversified croplands are areas suitable for both rice and diversified crops.

Source: NIA, 1988.

Table.6 Area planted to nonrice crops in national irrigation systems (NISs), the Philippines, 1989-90 and 1990-91 dry seasons.

Region (ha)	Service area (ha)	1989-90 dry season			1990-91 dry season		
		Served (ha)	Not served (ha)	Total (ha)	Served (ha)	Not served (ha)	Total (ha)
1	45,386				no report		
2	55,705				no report		
3	68,779	2,001	1,860	3,861	2,000	1,863	3,863
4	55,455	-	-	-	204	-	204
5	16,209				none		
6	53,500				none		
7	0				none		
8	15,633				none		
9	13,348				none		
10	22,732	58	-	58	178	-	178
11	48,876	3,387	-	3,387	3,387	-	3,387
12	37,610	662	3,729	4,391	441	3,949	4,390
MARIIS*	97,402	4	352	356	5	335	340
UPRIIS**	103,285	755	-	755	722	-	722
Total	633,920	6,867	5,941	12,808	4,937	4,284	9,221
% of service area				2.02			1.45

* Within Region 2.

** Within Region 3.

PROMOTING CROP DIVERSIFICATION IN RICE-BASED IRRIGATION SYSTEMS

While observations show the promising agronomic and economic performance of upland crops grown in the dry season with or after wetland rice, there is still a need to promote this system of production to a much wider area and a greater number of farmer adoptors. In this regard, the government has implemented a number of activities to address this concern.

Research and Development (R&D) Support

The Filipino farmers have been used to planting rice in the service areas of irrigation systems. Considering the contrasting requirements of rice and nonrice crops, technologies and information on the production of upland crops before or after rice become necessary to convince farmers and promote diversification. The Medium-Term Philippine Development Plan (MTPDP) (1987-92)

stipulates crop diversification as a strategy for increasing farm productivity, and expanded R&D activities are thereby encouraged. These R&D outputs should be available to support the promotion of crop diversification.

In the mid-1980s, the research program of the Department of Agriculture was focused on technology verification trials which were conducted in farmers' fields. In most cases the trials involved a test of cropping pattern options in lowland rice areas. The cropping system invariably included the growing of a nonrice (annual upland) crop in the traditionally rice-rice cropping pattern. Clearly, diversification within the rice farming system was a major objective. The research did result in concrete changes being adopted by the farmers. The rice-rice-mungbean pattern is now popular in some provinces in northern Luzon.

A 1988 comprehensive review of past accomplishments on R&D showed that there is still a lack of information on crop diversification in relation to irrigation. The International Irrigation Management Institute (IIMI) with support from the Asian Development Bank (ADB), started in 1985 a more comprehensive study on crop diversification in irrigated areas. In collaboration with research institutions in the country, the project identified the constraints and opportunities for crop diversification both at the system and farm levels. Two years later, the International Rice Research Institute (IRRI) joined forces with IIMI and national research agencies and institutions in conducting studies providing options to rice farmers. The studies focused on irrigation management, taking into consideration the technical, socioeconomic, institutional and managerial aspects of crop diversification.

The ADB-funded project on irrigation management for crop diversification showed that limited water supply and suitable soils were the main physical factors that enabled farmers to effectively irrigate rice and nonrice crops during the dry season. The active involvement of the irrigators' associations (IAs) in water allocation and distribution resulted in the optimal or effective use of the limited water supply. Further investigations into other factors like the rice priority policy and other socioeconomic incentives that will make irrigated crop diversification attractive and profitable to farmers were suggested.

The results of the IIMI-IRRI collaborative project also supported the earlier findings of the ADB project. The documentation and analysis of the procedures employed by both irrigation agencies and farmers in systems with mixed cropping have shown a clearer idea of these procedures. Opportunities and options for improving these procedures were also better perceived.

Considering the seemingly contrasting requirement of rice and nonrice crops, some studies have dealt with investigating specific factors that may influence changes in rice irrigation systems to accommodate nonrice crops. In characterizing these factors, recommendations and strategies have been identified to make their implementation more effective. These include: 1) system characterization and mapping; 2) use of better methodologies and techniques; 3) improved structural control; and 4) more active involvement of irrigators' associations and more farmer participation.

The involvement of farmers and farmer organizations as early as the planning stage may reduce problems during implementation. In systems with active irrigators' associations, the determination of the program area is facilitated through the participation of the IAs. Involvement of farmers during the planning stage does not necessarily mean teaching them to plan for themselves but explaining to them the necessity of the plan and reasons for the actions taken. This ensures farmers' commitment to abide by the plan. This also gives a feeling of importance on the part of the farmers.

Technology Transfer Programs

The Department of Science and Technology (DOST) has given the highest priority to technology transfer and commercialization to support economic development. It has strengthened collaboration with other government agencies, particularly the DA, to address this concern. This is also the present emphasis of the Philippines Council for Agriculture, Forestry and Natural Resources Research Development (PCARRD). After 18 years of R&D effort by the National Agriculture and Resources Research and Development Network (NARRDN), it is but logical to make use of most of the developed technologies that can be useful to and adopted or commercialized by the farmers, the private sector and other end-users. Appropriate technologies from R&D outputs must be transformed into outcomes in countryside development.

Pilot demonstrations/promotion projects. For the last several years, growing upland crops after rice has been piloted in a larger scale by PCARRD in collaboration with the DA and other research institutions and universities. Mungbean, soybean, lowland potato and wheat have shown promising yields and returns. Average yields of more than 1 t/ha have been achieved for mungbean, soybean and wheat, while for lowland potato, an average yield of 12 t/ha has been obtained, which is comparable with the yield in the highlands (15 t/ha).

In May 1987, the NIA and the Japan International Cooperation Agency (JICA) launched the Diversified Crops Irrigation Engineering Project (DCIEP). The Project aims to: 1) study the most appropriate method of providing irrigation to diversified crops; 2) establish design criteria for irrigation and drainage facilities for nonrice crops on irrigated rice fields; 3) study the importance and potential of diversified crops to develop more efficient utilization of available water and land resources, and establish comprehensive irrigated, diversified-crop farming systems; and 4) conduct technical training for NIA personnel and disseminate information for the introduction of diversified cropping systems. The expected output of the project is a manual of technical criteria and procedures for the guidance of engineers and related personnel in planning, designing, operating and maintaining irrigation and drainage facilities for crop diversification in existing NIA systems. It will also show the prospects and potentials of crop diversification in these systems.

The Diversified Crops Irrigation Engineering Center (DCIEC) is a complementary undertaking of the DCIEP. It is envisioned to provide the soil and water laboratories and a training venue for the DCIEP. Crop diversification in the NIA could be institutionalized through the DCIEP. The project is a strong manifestation of the desire of the NIA to promote adoption of nonrice crops in existing irrigation systems to attain a higher efficiency in water and land utilization. It is also a means of hastening the awareness of top- and mid-level field managers on the importance of crop diversification.

The DCIEC facilities could also provide continuing support for the activities of the Research Network on Irrigation Management for Crop Diversification in Rice-Based Systems (IMCD). The center would be open to the different countries in the region and could play an important role in the exchange of technology and research findings. It could serve as a venue for workshops, seminars and training programs of the Network while at the same time contributing its own breakthroughs and field-verified technologies.

Also relevant to crop diversification in rice-based systems is the pilot project on small-farm reservoirs (SFRs). This project was started in one region in 1989 and expanded to two other regions in 1990 and 1991. The SFR technology is basically an earth dam, indigenously developed by

farmers in Central Luzon to harvest and store rainfall and runoff. This structure is built using a bulldozer at the rate of 8-12 hours per unit. SFRs are being used in the rain-fed rice growing areas to provide supplemental irrigation of a rain-fed lowland wet season rice, partial irrigation of a dry season crop, and fish production.

IIMI started to pilot-test the results of its work in the Philippines since 1985. Irrigation management innovations had been discussed with the National Irrigation Agency (NIA) and farmers who agreed to trying them out in the field. Tests during one season showed promising results but activities had to be cut short because of the termination of support.

Information materials/publications. Promoting crop diversification could also be hastened by providing extension technicians and other users with the necessary information through published materials. As mentioned earlier, the DCIEP hopes to come up with a manual on the technical criteria and procedures on planning, designing, operating and maintaining irrigation and drainage facilities for crop diversification in existing NIA's systems. This will be used as a guide by engineers and other related personnel.

For extension technicians, PCARRD has lined up for publication the Philippines Recommendations for Irrigation Management for Diversifying Wetland Rice Areas. This has been initiated to: 1) translate the existing technical information on irrigation management for crop diversification into specific techniques/approaches, 2) provide management options/alternatives to irrigation system managers and water users for efficient allocation of resources, and 3) present recommendations and strategies to guide the formulation of policies for increased and sustainable productivity.

The publication will consolidate information on technologies developed through years of research. It will serve as a reference for irrigation system managers and farmers. Indigenous technologies developed by the farmers themselves will also be included when appropriate. It is hoped that it will serve as a catalyst that will hasten the spread and adoption of crop diversification in irrigated areas.

Development communication strategies. PCARRD implements technology packaging and dissemination programs through the Applied Communications Division. The division develops appropriate development communication strategies toward research utilization and technology diffusion.

In the regions, the Regional Applied Communication Outreach/Office (RACO) takes the lead in operationalizing technology packaging and dissemination activities. To date, there are 15 RACOs which are working components of the national and regional research consortia and centers which PCARRD coordinates.

To operationalize the research-extension interface function of RACO, PCARRD has established a linkage with the DA through the Agricultural Training Institute (ATI) and the Bureau of Agricultural Research (BAR) for an interagency collaborative effort in technology matching, packaging and dissemination activities. The signing of a memorandum of agreement in 1986 among these agencies set forth the National Integrated Applied Communication Program (NIACP).

The NIACP is a relatively recent and positive approach to the research-extension, farmer tie-up which is implemented at the national, regional and farm levels. At the national level, the program backstops technology transfer and maintenance activities of the PCARRD R&D network by retrieving and processing technical information for technology transfer. It develops this

technical information into communication materials directly usable by extension workers, farmers and producers. The DA multiplies and distributes these materials to the regions, and the program evaluates their impact.

The NIACP also established permanent linkages with agricultural communication/information offices within the R&D network in order to activate research information from all regions of the country into the mainstream of technology transfer activities. It provides training skills for the communication development of the staff of the research centers to enable them to implement a viable multi-media information dissemination activity, in support of the agriculture and natural resources development workers to make them more effective in the field.

Policy Support

Considering the broad base of the agricultural sector for economic growth potentials and its impact on development, policymakers are looking for ways and means to pursue an economic growth process anchored on agricultural sector development. Policies have therefore shifted emphasis from merely increasing agricultural production to raising farm productivity. This will provide a broader policy framework which considers not only productivity but all other factors that affect farmers' income such as prices, other income-generating activities, inputs, credit, etc.

Pricing policy. The pricing policy may be the single most important factor that influences rice farmers to diversify out of rice farming. The Philippine government currently maintains a price support for rice, based on cost of production, to protect the income of the farmers from adverse market conditions. However, the limited resources enable the government to procure only a small portion of the produce at the set price. Price fluctuations are, therefore, still inevitable in many areas. This instability in price causes farmers to consider other options. The incentive price mechanism provided by the government to boost production of other crops is also a major factor influencing the decision of farmers to diversify.

Tax and tariff policy. Major agricultural exports have previously had nominal taxes ranging from 4-10 percent, which in a way curtailed the volume of exports. The new policy removes these export taxes which may encourage the production of crops with export potential. Furthermore, it will make our products more competitive in the world market, i.e., to the extent that export taxes are passed on to the buyers in the form of higher market prices.

The reduction in the tariff rates for imported agricultural inputs is foreseen to motivate a shift toward the adoption of modern technologies. With a minimal tariff rate ranging from 0-5 percent *ad valorem*, the costs of agricultural inputs are expected to decrease, resulting in an increase in the use of better fertilizers, chemicals, and seeds, which, in turn, results in increased productivity.

Import liberalization measures in agriculture were done on a selective basis, depending on the domestic ability to produce and the overall impact on the sector. With the new trade policy, it is expected that agricultural productivity will increase since cost constraints have been reduced if not totally scrapped. This means that the country can now be directed toward the production of crops with a natural comparative advantage. For instance, although the country has a comparative advantage in corn production, it is not produced sufficiently in the sector and therefore, has been imported. With the move toward greater competition in the domestic market, there is an increasing

incentive to produce commodities that use domestic resources more efficiently. Corn is one of them.

Land tenure policy. Security of land tenure is essential if landholdings are to be developed and capital is to be invested. The government's land reform program is designed to give farmers the security of tenure in order to encourage them to intensify their crop production. Since any income gain resulting from intensified production activity will accrue only to them, the farmers now have an incentive to adopt income-increasing technologies. Thus, crop diversification, particularly in rice and corn areas, is expected to proceed favorably following the implementation of the Comprehensive Agrarian Reform Program (CARP).

Subsidy and credit policy. The gradual elimination of all subsidies is a national policy. The removal of subsidies in favored commodities is an attempt to allow greater competition in the market by removing policy and institutionally-initiated distortions that penalize the other (nonfavored) commodities.

Irrigation is one input that is subsidized by the government. Subsidy comes in the form of equity contributions to the NIA, budgetary appropriations for construction and maintenance of facilities, and interest charges on capital costs in the construction of irrigation facilities.

The NIA is now contemplating on improving its services through the restoration of irrigation facilities which anticipates that an increase in the efficiency of irrigation service fee collection will follow. This is the major focus of the Irrigation Operations Support Project (IOSP) which the NIA is now implementing nationwide.

Credit programs are based on the concept of the Integrated Rural Financing (IRF) Project of the Department of Agriculture (DA). This is a credit facility for the farm household, based on a whole farm budget for a multicrop/livestock enterprise. IRF is also offered at rates below the market rates.

Irrigation service fee rates. The NIA has been collecting lower irrigation service fees for nonrice crops. It charges 60 percent of the rates established for rice when farmers plant nonrice crops. In a way, this encourages the production of nonrice crops.

APPROPRIATE STRATEGIES TO PROMOTE CROP DIVERSIFICATION

While it may be argued that diversification may not need any push from the government because the farmers will automatically diversify if the conditions are conducive, promoting the implementation of crop diversification could still be hastened and facilitated with government support and intervention. However, the aggressive programs that already exist to promote diversification still need some kind of coordination to effect stronger complementation among these activities and the different sectors pursuing them. The establishment of a multi-sectoral linkage system is necessary to effect complementation, supplementation and effective coordination. Thus through a Memorandum of Agreement (MOA) among concerned agencies, the National Committee on Crop Diversification (NCCD) has been created.

The NCCD hopes to implement a functional working relationship among the various agencies to push crop diversification. Signatories to the agreement are the Department of Agriculture (DA), the Department of Agrarian Reform (DAR), the Department of Science and Technology (DOST), the National Economic and Development Authority (NEDA), and the National Irrigation Administration (NIA). The committee provides a working mechanism for better linkages among the research, extension, policy and infrastructure services.

This has been made clear in the MOA. As stipulated, the Committee shall: 1) coordinate the formulation, development and implementation of a comprehensive program on crop diversification in the country to include research, development, training and extension; 2) facilitate the provision of necessary technical, financial and other support services for the implementation of the program; 3) formulate and recommend policies promoting crop diversification and zonification; and 4) serve as the link between the national program and other related programs within the country as well as outside the country.

The Committee is now in the process of formulating a national crop diversification program laying emphasis on rice-, corn-, coconut- and sugarcane-based areas. Working groups have been created to tackle the individual programs.

During the national consultation on crop diversification held on 30 August 1991 at PCARRD, a general framework on crop diversification was presented and agreed upon. For diversification in rice-based systems, it was agreed that the areas currently devoted to rice should not be reduced by the added cultivation of other crops. Areas that have a limitated supply of irrigation water either due to inadequate supply or difficulty in holding water for rice production may be considered for diversified cropping.

The consultation also agreed on a plan of how to carry on crop diversification in rice-based systems. Table 7 shows the general areas of concern and institutional participation to carry out the plan, while Table 8 gives the identified areas for R&D. The NCCD will repackage the plan, considering the comments and suggestions during the workshop. The NCCD will also look for funds to operationalize the plan.

Table 7. Areas of concern and institutional participation (rice- and corn-based crop diversification).

Areas of concern	Agencies involved
1. Database compilation and updating	
a. Land resource use for rice, corn and crops used in crop diversification	DA-BSWM, NIA, BAS, DA-Regions
b. Completed and ongoing R&D projects related to crop diversification	PCARRD, DA-BAR, UPLB-FSSRI, CLSU, PHILRICE, NAPHIRE, USM
c. National/regional programs on water resources development and management related to crop diversification	NIA, CLSU, BSWM, UPLB, PHILRICE
d. Socioeconomic and market data	PCARRD, NEDA, DTI, DA-Agri-business, DA-BAS
2. Information campaign, training, extension services	DA-ATI, SCUs, PCARRD Consortia Media
3. Seed production, storage, and distribution	DA-BPI, UPLB, CLSU & other SCUs, Private companies NAPHIRE, PHILRICE, NFA
4. Irrigation systems and other infrastructure development and improvement	NIA, BSWM, NFA, FTI, BPWH, Private firms
5. Credit and support services	LBP, Rural Banks, DBP, NLSF, Cooperatives, TLRC
6. Postharvest and marketing	NAPHIRE, DA-Agribusiness, NFA
7. Research and development	DOST-PCARRD, DA-BAR, SCUs, NIA, DA-Regions, PHILRICE, NAPHIRE
8. Overall coordination	DA-BAR, DOST-PCARRD Interagency

Table 8. Research and development concerns and agency involvement (rice- and corn-based crop diversification).

	R&D concerns	Agencies involved
1.	Developing package of technologies for specific/recommended cropping patterns	PCARRD & NARRDN, DA-BAR, DA Regions
2.	Expanded studies on corn-based cropping systems	DA-Regions, UPLB-FSSRI, USM
3.	Field-testing of newly generated rice- and corn-based cropping systems	DA-Regions, UPLB-FSSRI
4.	Water augmentation system development and management (shallow groundwater pumps)	NIA, CLSU, BSWM, UPLB
5.	Small water-impounding projects (SWIP), small farm reservoirs (SFR), communal systems development and management	CLSU, NIA, BSWM
6.	Developing water management and irrigation delivery plan for diversified cropping system	NIA-DCIEP
7.	Piloting diversified crop production projects with water management schemes	NIA-DCIEP
8.	Drainage systems improvement for crop-diversified areas	NIA, CLSU, UPLB, IRRI
9.	Biofertilizer studies	UPLB, BSWM, DA-Regions
10.	Development of small machinery and equipment firms	DA-BPI, AMDP, AMTEC Private
11.	Post-production studies for crops other than rice and corn	NAPHIRE, UPLB, CLSU
12.	Socioeconomic studies on crop diversification	UPLB, CLSU, other SCUs
13.	Policy/market studies	UPLB, DA-Agribusiness, CLSU, BAS

CONCLUSIONS AND RECOMMENDATIONS

Role of National Institutions and Agencies

Although crop diversification is also within the national thrust of Philippine agricultural development, its promotion in rice-based areas has not been done aggressively. This is due to the government's policy of increasing rice production to attain self-sufficiency. However, there is a large hectarage of rain-fed rice that can contribute substantially to increase the production of nonrice commodities. These are the main areas initially identified for crop diversification.

Another aspect that has still room for improvement is the agency coordination as far as crop diversification is concerned. Although there are agencies responsible for coordination of R&D activities and training and extension, a holistic approach to address the whole continuum from research generation to extension and utilization, and the necessary support policies and services to implement the program is still lacking. This apparent lack of coordination could hopefully be addressed by the creation of the NCCD.

Role of Other Countries and International Institutions

Interdependence among countries can help much in the promotion of crop diversification. Aggressive trade among countries in nonrice crops will further help promote crop diversification. Development of intercountry marketing linkages at least within the region can be a very important project of the network.

The International Agricultural Research Centers (IARCs) are very good sources of expertise and consultancy services which the national agencies could tap. Since the IARCs usually deal with specific commodities, they could contribute to technology generation and promotion of alternative crops that could be considered in crop diversification. They should also be able to assist in packaging and drawing up of proposals for funding by donors such as the World Bank (WB), Asian Development Bank (ADB), and others.

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