CROPPING SYSTEM MONITORING OF VEGETABLE FARMS IN BENGUET AND MT. PROVINCE (1989 DRY AND WET SEASON)[1]

VOLUME I

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ABSTRACT

Vegetable farms were surveyed in 5 municipalities (Atok, Bauko, Buguias, Kibungan and Mankayan) in Benguet and Mt. Province with the participation of 43 farmers during dry season (DS) and 51 farmers during wet season (WS) of 1989. Agronomic practices were weekly monitored; farm profile and economic data were gathered. Average farm sizes in the surveyed area ranged from 0.6 to 1.77ha and area planted to crops ranged from 0.21 to 0.70ha. Crops monitored were cabbage, potato, Chinese cabbage, carrot, radish, celery, lettuce, sweet pea and string beans. Potato and cabbage were the dominant crops planted on 93% of the total area utilized during DS and 82% during WS. Other minor vegetables covered 7% during DS and 18% during WS. Concerning planting pattern, farmers tend to plant crops 3 to 4 times a year. Potato/cabbage was the most common combination but other minor crops were planted in the later part of the season. In terms of farm operations, it was very labor intensive because of the rolling and sloping topography of most of the farms. Planting of cabbage into seedbeds was done one month before land preparation. During DS land preparation started in January and May during WS. This was followed by transplanting cabbage seedlings or planting of potato tubers and other vegetables using seeds as planting materials. Heavy fertilization with organic matter (chicken manure) was applied during land preparation followed by inorganic fertilizer (basal and foliar) one month later. Weeding was done by hand-pulling and hoeing. Spraying with pesticides was done on vegetables one to three months after planting. Cabbage seedlings were sprayed with pesticides while on the seedbeds. The most common insecticides used for both seasons belonged to the organophospates followed by pyrethroids. In case of fungicides, mancozeb was dominantly used. Only few farmers used herbicides. For potato delayed

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1. This report has been made in the framework of the Philippine-German Biological Plant Protection Project (PGBPPP), a cooperation between Bureau of Plant Industry and Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, funded by the German Government

harvesting was practiced while priming or selective harvesting was done on cabbage.

The demographic data showed that respondents were mostly male, belonging to Kankaney tribe, 30-39 years old, have 5-8 years of schooling, have devoted 6-10 in farming and 1-5 years operating their farms. Farmers borrowed money ranging from ₱2,000 (foundation) to ₱60,000 (bank/dealer) with an average interest rate of 23% during DS and 18% during WS. The *quantitative yield analysis* showed that many farmers suffered yield losses up to 100% for some of the crops especially during WS because of natural calamities. During DS only 24% out of 25 cabbage farmers achieved good yields with 45-66 t/ha and 32% farmers almost had total losses with less than 10 t/ha. In WS, 5 cabbage farmers experienced total loss. Fifteen farmers had yields less than 10 t/ha and only 5 out of 34 cabbage farmers had good harvests with 33-46 t/ha. Potato farmers on the other hand, had good yields during WS with about double amount per hectare compared to the DS. For both seasons, there was no recorded total loss for this crop. Minor crops like Chinese cabbage and carrot had much higher yields in WS than in DS. The *costs and returns and cost component analysis* were based on the different crops. Non-cash costs (family labor, interest on operating capital, etc.) were not considered for the analysis. Cabbage during DS and Chinese cabbage during WS were found to be the most profitable crops according costs and returns analysis. As for potato, cash input was higher than the returns of the sold produce. This cash input comprised of tubers, hired labor, fertilizer, marketing cost and fungicides. Regarding pesticide costs, cabbage and Chinese cabbage demanded a high input of insecticides, whereas for potato fungicides played an important part in production costs. For carrots, insecticides and herbicides had a big share of the inputs. The non-cash cost "family labor" was for all crops the highest "financial" input in crop production. *Farm income analysis* showed that the average net cash income per hectare during DS was ₱54,639/ha and -₱24,853 during WS. The negative result in WS was due to natural calamities. Concerning cropping pattern, any combination with carrot gave the highest net cash incomes, second was the cabbage/potato combination which was used by most of the farmers during DS. On-the-other-hand, cabbage mono-crop farmers incurred the largest average net cash losses during WS. *Labor input analysis* revealed that potato was the most labor-intensive crop, followed by cabbage and finally carrot.

INTRODUCTION

Since April 1987 the Philippine-German Biological Plant Protection (PGBPPP) is engaged in the development and adjustment of biological control methods against pests in corn and vegetables as part of pest management. One of the fields of activity is cabbage production in the highlands where the trust is directed to find pest control strategies to control especially the diamondback moth, the most important pest in tropical cabbage fields. Up to now farmers depend heavily on insecticides in order to secure their crop against this pest. In order to avoid a failure of this approach it is important to identify the target group and their specific working conditions, needs and goals. Only then it is possible to work out proper recommendations and achieve a high acceptance among the target group.

It was aimed to gather the necessary data to facilitate an economic analysis of the present situation of the farmers in this area

and evaluate the chances and basic requirements for the implementation of a pest management program. The following objectives were given:

1. Identify the prevailing cropping systems in Benguet and Mountain Province.
2. Describe the cropping patterns and management practices
3. Give an economic assessment of vegetable production in the two provinces.
4. Assess the conditions under which potential biological plant protection technologies could be acceptable to vegetable growers.

FARM PROFILE & AGRONOMIC PRACTICES

Volume I aims to introduce the area monitored by the survey and distribute the basic data concerning farm profile, agronomic practices and applied plant protection methods.

1.0 FARM PROFILE

The average farm sizes surveyed in Mankayan and Atok were 1.77 and 1.02 ha, respectively. In the other municipalities the average size of farms was around 0.6 ha.

In respect of land tenure, 91% of the utilized farm lands were private property of the farmers who worked on it. The remaining 9% of farm lands were rented to 16% of the farmers in DS and 18% during WS. In Mankayan, farmers did not rent out their fields whereas in the other municipalities farmers with big farm areas who could not cultivate all of their farm land tended to rent some of it to other farmers or allowed relatives to use it without rental. Acquisition of farm land was usually through inheritance.

During dry season, 61% of the farms were irrigated compared to 35% during wet season.

Not all of the arable land of the farms was utilized. During the dry season (DS), 50% of the arable farm area was planted to crops and 45% during the wet season (WS).

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The demographic data showed that respondents were mostly male, belonging to Kankaney tribe, 30-39 years old, have 5-8 years of schooling, have devoted 6-10 in farming and 1-5 years operating their farms. Farmers borrowed money ranging from ₱2,000 (foundation) to ₱60,000 (bank/dealer) with an average interest rate of 23% during DS and 18% during WS. The *quantitative yield analysis* showed that many farmers suffered yield losses up to 100% for some of the crops especially during WS because of natural calamities. During DS only 24% out of 25 cabbage farmers achieved good yields with 45-66 t/ha and 32% farmers almost had total losses with less than 10 t/ha. In WS, 5 cabbage farmers experienced total loss. Fifteen farmers had yields less than 10 t/ha and only 5 out of 34 cabbage farmers had good harvests with 33-46 t/ha. Potato farmers on the other hand, had good yields during WS with about double amount per hectare compared to the DS. For both seasons, there was no recorded total loss for this crop. Minor crops like Chinese cabbage and carrot had much higher yields in WS than in DS. The *costs and returns and cost component analysis* were based on the different crops. Non-cash costs (family labor, interest on operating capital, etc.) were not considered for the analysis. Cabbage during DS and Chinese cabbage during WS were found to be the most profitable crops according costs and returns analysis. As for potato, cash input was higher than the returns of the sold produce. This cash input comprised of tubers, hired labor, fertilizer, marketing cost and fungicides. Regarding pesticide costs, cabbage and Chinese cabbage demanded a high input of insecticides, whereas for potato fungicides played an important part in production costs. For carrots, insecticides and herbicides had a big share of the inputs. The non-cash cost "family labor" was for all crops the highest "financial" input in crop production. *Farm income analysis* showed that the average net cash income per hectare during DS was ₱54,639/ha and -₱24,853 during WS. The negative result in WS was due to natural calamities. Concerning cropping pattern, any combination with carrot gave the highest net cash incomes, second was the cabbage/potato combination which was used by most of the farmers during DS. On-the-other-hand, cabbage mono-crop farmers incurred the largest average net cash losses during WS. *Labor input analysis* revealed that potato was the most labor-intensive crop, followed by cabbage and finally carrot.

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2.0 AGRONOMIC PRACTICES

2.1 Overview of farm operations.

Land preparation started in January 1989 in DS and in May during WS (Figure 1). It was very labor intensive because of the rolling and sloping topography of most farms in the survey area which allows most farmers to use only simple hand tools for clearing and digging the fields.

Planting into seedbeds in case of cabbage and occasionally of celery and lettuce land preparation was preceded in general one month earlier. In that way farmers could maximize the utilization of farm land and reduce the abundance of soil-borne diseases. For other crops like Chinese cabbage, carrot, radish, sweet peas, lettuce and celery seeds were used as planting material. In case of potato the use of seed tubers was the most popular method.

Chicken manure was the sole organic fertilizer used. It was incorporated into the soil during land preparation. Almost all farmers applied chicken manure for cabbage, potato, Chinese cabbage and celery (only in DS) whereas for carrot, sweet peas and lettuce only about 2/3 of the farmers resorted to organic fertilizer application. Basal inorganic fertilizer was also used for almost all crops. In case of foliar fertilizer it was used mainly on cabbage, potato and Chinese cabbage but only minimal or not at all for the other crops.

Immediately after land preparation the seedlings were transplanted.

Weeding was done 1 month after inorganic fertilizer application by hand-pulling, hoeing or hilling-up. Only few farmers used herbicides.

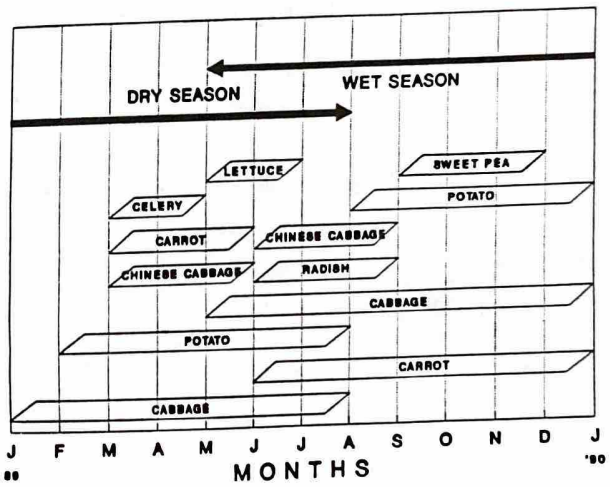
Application of pesticides to control insect pests and diseases was done 1 - 3 months after planting for most of the crops. Cabbage, lettuce and celery seedlings were treated while still in seedbed. Diamondback moth and cutworm as well as blight disease of potato were the most common reason given by farmers why they use pesticides.

To get a higher price delayed harvesting of potato was practiced by farmers. Another practice was dehaulming of potato to harden the skin, subsequently reducing the risk of damage during packaging and transporting which would result in a lower market price.

In cabbage priming or selective harvesting was done by harvesting 1 - 4 times depending on when cabbage heads mature and have heavy weight.

Cabbage and potato production is going on all the yearround. Seedbed preparation for cabbage started in January and harvesting for the dry season was over at the beginning of August. For the wet season seedbed preparation started already in May and harvesting of the wet season crop ended in January of the following year. For potato, first placement of tubers started with land preparation in February and last harvesting was done in August. Immediately after harvest the next planting of potato started with last harvesting in January the following year.

Figure 1. Farm operations in Benguet and Mt. Province during dry and wet season 1988-90



2.2 Crops planted in dry (DS) and wet (WS) season.

The decision of what crop will be planted depends very much on climatic conditions: dry season from November to April/May and wet season from June to October.

Potato and cabbage (major crops) were the dominant crops planted on 93% of the total area utilized during DS and 82% during WS. Minor crops (Chinese cabbage, carrot, radish, sweet pea, lettuce, celery and beans) were dominantly - or in case of radish, sweet pea and lettuce only then - grown during the WS and covered 18% of the utilized farm land in WS compared to only 7% in DS.

The proportion of area planted to the different crops varied with the seasons. Whereas potato dominated during DS, the situation was reversed in WS when only 29% of the utilized area was planted to potato and 54% to cabbage. Also, there was a difference in which minor crops were planted additionally to the major crops. During DS only carrot, celery and Chinese cabbage were planted. During WS the range of additional crops was wider with carrot, Chinese cabbage, lettuce, sweet peas, radish and stringbeans.

In respect to number of farmers planting different crops the same pattern can be seen (Table 1). Based on the 51 (only 43 in DS) farmer-respondents, potato was grown by 84% of the farmers in DS and by only 61% in WS. During WS, the percentage of farmers growing cabbage increased from 58% (DS) to 67%. Also, Chinese cabbage and carrot were planted by more farmers during WS than during DS.

Table 1. Farmers and area planted with different crops, (DS & WS, 1989).

Crop		planted by .. farmers DS (43)		WS (51)		Area planted to ..... DS (25.31 ha)		WS (23.74 ha)	
Cabbage	(CA)	25	58%	34	67%	7.034 ha	28%	12.671 ha	54%
Potato	(PO)	36	84%	31	61%	16.438 ha	65%	6.899 ha	29%
Ch. cabbage	(CC)	3	7%	9	18%	0.399 ha	2%	0.999 ha	4%
Carrot	(CR)	7	16%	15	29%	1.221 ha	5%	1.623 ha	7%
Radish	(RA)	-	-	5	10%	-		0.556 ha	2%
Sweet Peas	(SP)	-	-	4	8%	-		0.433 ha	2%
Lettuce	(LE)	-	-	3	6%	-		0.367 ha	2%
Celery	(CE)	1	2%	1	2%	0.042 ha	.2%	0.003 ha	.01%
Stringbeans	(SB)	-	-	1	2%	-		0.026 ha	.1%

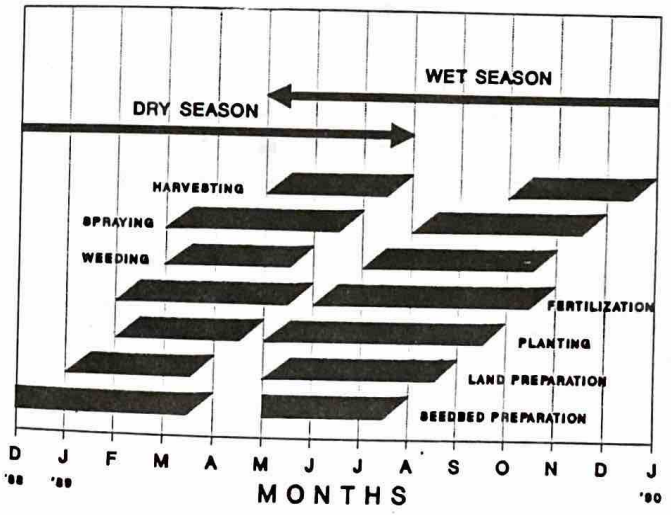
The reason for this planting pattern was stated by farmers to avoid certain risk factors. Potato is dominantly endangered by black rot and late blight (*Phytophthora infestans*) during WS and faces less

problems during DS. In case of cabbage and the other crops the climatical conditions during WS reduces the abundance of lepidopterous pests (DBM, cutworm etc.) by entomophagous fungal diseases.

Concerning the planting pattern it was found that farmers in the surveyed area tend to plant crops 3 - 4 times a year. The survey also revealed that during DS cabbage and potato was the most common combination. During WS, monocropping of cabbage (23.53%) was the most common cropping pattern, followed by potato (15.69%).

On larger farms potato and cabbage were combined with other crops within one season, but these minor crops were planted in the later part of the season. The peak month of planting cabbage, potato and carrot was in March and August of 1989 for DS and WS, respectively. Chinese cabbage and carrot were grown from March to June (DS) and June to September (WS).

Figure 2. Crop rotation in Benguet and Mt. Province during dry and wet season 1989-90



2.3 Fertilizer application

Organic fertilizer. Chicken manure was the sole organic fertilizer used by almost all of the respondents and was applied during land preparation. In total, during DS 291,675 kg of chicken manure has been applied to 23.29 ha and during WS 226,025 kg on 22.63 ha. The recommended rate of chicken manure for potato is 2-3 mt per hectare and celery is 600-800 kg/ha which shows that there was heavy application of organic fertilizer to potato for both season and celery during WS. Considering the application of chicken manure per hectare, the amount decreased in WS for all crops except for Chinese cabbage which received about the double amount during WS (Table 2).

Table 2. Chicken manure application to different crops, (DS & WS, 1989).

	Crop	Farmer	Area	Chicken manure	on .... ha	by .... farmers	Total N	Total P	Total K
DS:	CA	25	7.034 ha	66725 kg	5.8067 ha	24	2609	3176	2288
WS:		34	12.671 ha	138050 kg	12.6710 ha	34	5398	6571	4735
DS:	PO	36	16.438 ha	213775 kg	16.3004 ha	35	8359	10176	7332
WS:		31	6.899 ha	69475 kg	6.8030 ha	31	2716	3307	2383
DS:	CC	3	0.399 ha	2000 kg	0.3980 ha		78	95	69
WS:		9	0.999 ha	10550 kg	0.9990 ha	9	413	502	362
DS:	CR	7	1.221 ha	9050 kg	0.7432 ha	5	354	431	310
WS:		15	1.623 ha	6000 kg	0.9297 ha	11	235	286	206
WS:	SP	4	0.433 ha	500 kg	0.3233 ha	3	20	24	17
WS:	LE	3	0.367 ha	1450 kg	0.1139 ha	2	57	69	50
DS:	CE	1	0.042 ha	125 kg	0.042 ha	1	5	6	4
WS:		1	0.003 ha	-	-	-	-	-	-
DS:	TOTAL	43		291675 kg	23.29 ha	42			
WS:		51		226025 kg	22.63 ha	51			

Inorganic fertilizer. The most common basal fertilizer used were 14-14-14 and 16-16-16 as well as urea (46-0-0). Additionally, powder and liquid foliar fertilizers (20-20-20 and 8-8-8) were commonly used. In Tables 3-5, the data show that - as already noted in

Table 3. Basal fertilizer application to different crops (DS & WS, 1989)

	Crop	Farmer	Area	Basal fertilizer	on .... ha	by .... farmers	Total N	Total P	Total K
DS:	CA	25	7.034 ha	10590 kg	6.4899 ha	23	2061	1166	1070
WS:		34	12.671 ha	17600 kg	12.4604 ha	32	3441	1804	2020
DS:	PO	36	16.438 ha	27598 kg	16.3617 ha	35	4222	3645	3886
WS:		31	6.899 ha	8730 kg	6.8990 ha	31	1324	1081	1189
DS:	CC	3	0.399 ha	401 kg	0.2112 ha	2	104	35	35
WS:		9	0.999 ha	1296 kg	0.9990 ha	9	328	94	89
DS:	CR	7	1.221 ha	1595 kg	1.1199 ha	5	128	249	116
WS:		15	1.623 ha	1065 kg	1.0589 ha	9	198	129	129
WS:	SP	4	0.433 ha	98 kg	0.3233 ha	3	20	24	17
WS:	LE	3	0.367 ha	550 kg	0.3670 ha	3	143	37	35
DS:	CE	1	0.042 ha	50 kg	0.042 ha	1	7	7	7
WS:		1	0.003 ha	-	-	-	-	-	-
DS:	TOTAL	43		40234 kg	24.2247 ha	42			
WS:		51		29339 kg	22.1076 ha	50			

Table 4. Foliar powder fertilizer application to different crops (DS & WS, 1989).

	Crop	Farmer	Area	Foliar powder	on .... ha	by .... farmers		Total N	Total P	Total K
DS:	CA	25	7.034 ha	7.00 l	0.8405 ha	3	12%	0.59	0.40	0.54
WS:		34	12.671 ha	48.67 l	5.9077 ha	19	56%	5.24	2.22	2.52
DS:	PO	36	16.438 ha	21.75 l	1.9902 ha	4	11%	1.63	1.65	1.68
WS:		31	6.899 ha	12.22 l	1.9384 ha	9	29%	1.07	0.70	0.83
DS:	CC	3	0.399 ha	-	-	-	-	-	-	-
WS:		9	0.999 ha	2.32 l	0.2662 ha	3	33%	0.25	0.08	0.10
DS:	CR	7	1.221 ha	2.50 l	0.6061 ha	2	29%	0.24	0.24	0.19
WS:		15	1.623 ha	0.50 l	0.2229 ha	1	7%	0.04	0.04	0.04
WS:	LE	3	0.367 ha	0.22 l	0.0345 ha	1	33%	0.02	0.01	0.01
DS:	CE	1	0.042 ha	0.50 l	0.042 ha	1	100%	0.06	0.02	0.03
WS:		1	0.003 ha	-	-	-	-	-	-	-
DS:	TOTAL	43		31.75 l	3.4788 ha	8	19%			
WS:		51		63.93 l	8.3697 ha	27	53%			

Table 5. Foliar liquid fertilizer application to different crops (DS & WS, 1989).

	Crop	Farmer	Area	Foliar powder	on .... ha	by .... farmers		Total N	Total P	Total K
DS:	CA	25	7.034 ha	3.9 kg	0.8554 ha	3	12%	1.24	0.37	0.37
WS:		34	12.671 ha	6.6 kg	0.7840 ha	5	15%	1.91	0.59	0.57
DS:	PO	36	16.438 ha	8.9 kg	1.356 ha	4	11%	0.68	1.59	2.03
WS:		31	6.899 ha	18.5 kg	2.9909 ha	9	29%	2.21	2.73	5.04
DS:	CC	3	0.399 ha	-	-	-	-	-	-	-
WS:		9	0.999 ha	2.4 kg	0.2161 ha	3	33%	0.65	0.33	0.33
DS:	TOTAL	43		12.8 kg	2.2114 ha	4	9%			
WS:		51		27.5 kg	3.9910 ha	14	28%			

organic fertilizer - the amount of inorganic basal fertilizer applied to different crops decreased during WS in a range of 10 - 20% compared to DS. The areas treated with foliar fertilizers were unimportant compared with the areas treated with basal fertilizer and covered only in average about 1/3 of the area treated with basal fertilizer. There was heavy application of basal fertilizer based on the recommended rate for potato (90-150 kg N, 100-150 kg P and 150-200 kg K per hectare) and Chinese cabbage (90-240 kg N, 30-60 kg P and 30-60 kg K).

3.0 PLANT PROTECTION

3.1 On soil.

Soil treatment with insecticides during DS and WS was done by 51 and 35% of the farmers, respectively. Total areas treated with insecticide were 4.33 ha (DS) and 9.70 ha (WS). Diazinon (organophosphorus) and Carbofuran (carbamates) as wettable powder were the most common insecticides used in both seasons. Soil treatment was done for cabbage, potato, Chinese cabbage and carrot fields.

The amount of powder insecticide used was 80.92 kg (4.0724 ha) in DS and increased to 96.75 kg in WS due to increase in hectarage treated (9.3943 ha). Liquid insecticides were used minimally by 2 and 11% of the cabbage farmers in DS and WS, respectively.

3.2 On the seeds and tubers.

In DS, seeds of cabbage, carrot and potato tubers were treated with insecticides and/or fungicides only by some of the farmers concerned. In WS the only crops treated were cabbage seeds and potato tubers. The most commonly used fungicide was Cymoxanil+Mancozeb and the most common insecticide used was Fenvalerate (pyrethroid). Growth regulator was used only for potato tubers.

Cabbage: Seed treatment with fungicides (no insecticides used) was done by 8-9%[1] of the cabbage growers in both seasons.

Potato: About 31% of the potato growers treated their tubers with insecticides and fungicides in DS and 6% in WS.

Carrot: One farmer (14%) growing carrot has treated his seeds with fungicide (no insecticides used) during DS but nobody during WS.

3.3 On seedlings.

The amount of powder and liquid insecticides applied during DS for all crops was 1.13 kg and 7.16 l, respectively. The corresponding figures for WS were in the same range with 1.91 kg and 7.3 liters.

Insecticides: Chlorfluazuron (trifluoromethyl) and Fenvalerate (pyrethroid) were the most commonly used insecticides in DS while Methamidophos (organophosphorus) during WS.

Cabbage: Spraying of insecticides for cabbage seedlings was done by 92% cabbage growers in DS and 79% in WS. Seedlings received 1.25 l/ha during DS. The amount decreased to almost half of it during WS (0.67 l/ha). The use of powder insecticides to cabbage seedlings ranged from 0.61 to 0.75 kg/ha in both seasons.

Potato: Only 1 farmer treated potato seedlings with 0.10 l/ha and 0.03 kg/ha of insecticides during DS.

Celery and lettuce: In case of celery which was planted by .....

1. The figures in section 3.0 concerning percentage of farmers using pesticides for particular crop refers - if not indicated differently - to 100% equals all farmers growing this particular crop

only 1 farmer insecticides were applied only in WS. For lettuce seedling treatment was done by 66% (2 out of 3) of the farmers (WS).

Fungicides: Among the fungicides, Mancozeb was dominantly used in DS while Cymoxanil+ Mancozeb was used by cabbage and lettuce farmers in WS.

Only cabbage seedlings were treated with fungicides by 16% of the cabbage farmers during DS with an amount of 1.43 kg/ha. During WS, only cabbage and lettuce seedlings were treated with fungicides (CA: 0.32 kg/ha [1.31 l/ha] on 8.7571 ha [1.5363 ha] by 17 [4] farmers; LE: 0.45 kg/ha on 0.3322 ha by 2 farmers).

3.4 Field application of pesticides

Insecticides: Table 6 shows the different groups of insecticides used by farmers during dry and wet season, 1989. The most common insecticides for both seasons belong to the groups of organophosphorus (e.g. Methamidophos), pyrethroids (Fenvalerate) and carbamates (Cartap HCl).

Table 6. Insecticide field application to different crops during DS & WS 1989.

	Dry Season			Wet season		
Insecticide group	No. of Farmers	Total Area (ha)	Total Amount	No. of Farmers	Total Area (ha)	Total Amount
Organophoshorus	30	9.1612	53.17 l	27	10.6624	70.78 l
Pyrethroid	26	11.3588	46.03 l	25	10.2831	76.33 l
Organochlorine	14	6.6490	18.44 l	13	3.1431	14.52 l
Trifluoromethyl	10	1.8383	8.36 l	9	3.0512	8.94 l
Organoflourine	12	3.2725	9.31 l	7	2.8487	3.13 l
Others	1	0.3549	1.00 l	1	0.8341	1.00 l
Biological	7	1.6503	12.23 kg	9	1.8617	8.21 kg
Carbamates	14	4.0156	26.44 kg	18	4.0156	26.44 kg
Diazinon	3	0.7803	33.00 kg	1	0.7803	33.00 kg

It is interesting to note that not all farmers were using insecticides to protect their crops. In DS, 7% and 14% of the farmers in WS did not apply insecticides. Total area treated with insecticides by 93% of the farmers during DS was 19.568 ha and 15.785 ha by 86% of the farmers during WS.

The amount of all liquid insecticides used by farmers (by 93% of respondents) during DS was 174.5 l sprayed onto an area of 19.2832 ha. During WS, the amount of liquid insecticides stayed the same with 174.7 l but the hectarage treated and percentage of farmers using them decreased to 15.725 ha and 86%, respectively. In case of powder insecticides 40% of the farmers used them in DS on an area of 4.541 ha (71.67 kg). In WS the amount declined to 29.35 kg applied by 39% of the farmers on an increased area of 6.766 hectares.

Cabbage: All cabbage farmers (25) sprayed liquid insecticides onto a total area of 6.2112 ha with 21.57 l/ha during DS and 11.70 l/ha on 12.3075 ha during WS (94% of the cabbage farmers). For powder insecticides the figures are: 68% of the cabbage farmers during DS used 15.56 kg/ha on a total area of 4.4109 ha In WS 50% of the farmers applied an amount of 3.75 kg/ha on 6.4226 ha of cabbage fields.

The most common insecticides used were Methamidophos (organophosphorus) and Cartap HCl (carbamates) for both seasons.

In respect to biological insecticides (based on *Bacillus thuringiensis*), only 28% of the farmers growing cabbage during DS used them with an amount of 7.41 kg/ha per season on 1.6503 ha and a frequency of 1-3 applications. In WS, there was an increase of cabbage farmers (to 76%) who used biological insecticides with an amount of 3.87 kg/ha on 1.8617 ha which was sprayed 1-4 times during the growing period.

Potato: Eighty six percent of the potato farmers applied liquid insecticides with an amount of 3.45 l/ha for an area of 16.0059 ha and 4.62 kg/ha for an area of 0.6495 ha (8% potato farmers) during DS. There was an increase of liquid insecticides to 4.58 l/ha to an area of 3.4124 ha (48% farmers) and a decrease of powder insecticides to 1.56 kg/ha with an area of 0.154 ha (3% farmers) during WS.

The most common insecticides used were Methamidophos (organophosphorus), Fenvalerate (pyrethroid) during DS and Endosulfan (organochlorine) during WS.

Carrot: Only liquid insecticides were used by 86% of the carrot farmers during DS with an amount of 2.32 l/ha to an area of 1.1522 ha. In WS, there was an increase to 3.07 l/ha by 40% of carrot farmers to an area of 0.7792 ha. Seven percent (7%) of the carrot farmers used 4.44 kg/ha powder insecticides on 0.0225 ha.

The most commonly used insecticide for this crop during DS was Methamidophos (organophosphorus) while Endosulfan (organochlorine) dominated during WS.

Chinese cabbage: There was no powder insecticide used during DS. The area treated by 67% of farmers growing this crop with 9.04 l/ha insecticides was 0.2112 ha and very minimal difference was recorded for WS with 9.34 l/ha applied to 0.9982 ha by all the Chinese cabbage farmers. However, there was an additional application of 5.32 kg/ha insecticide on 0.249 ha by 78% farmers during WS.

There was no preference for a special insecticide during DS but in WS, Profenophos (organophosphorus) was mostly used.

Biological insecticide (*Bacillus thuringiensis*) was used by 22% of the Chinese cabbage farmers during WS with 5.80 kg/ha on 0.1741ha with an application frequency between 2 and 8 times.

Celery, lettuce, sweet peas and string beans: Organophosphorus insecticides were commonly used for these crops. Only liquid insecticides were used in celery (DS only), lettuce, sweet peas and string beans in WS with amounts of 13.33, 8.03, 1.27 and 1.92 l/ha to 0.042, 0.3537, 0.2594 and 0.0260 ha, respectively.

Fungicides. In both seasons, the three most common fungicides were Mancozeb, Cymoxanil+ Mancozeb and Copper oxychloride.

In general, the use of liquid fungicides for all crops increased tremendously during wet season. Fungicides were used by 88% and 90% farmers during DS and WS, respectively. Fungicide applications for potato, cabbage, Chinese cabbage, celery and carrot in DS were 31.91 kg/ha (area = 19.4568 ha) and 0.81 l/ha (area =5.2603 ha; used for potato only). In WS, amounts of 1.31 kg/ha and 2.68 l/ha were used by 90 and 40% farmers, respectively.

Cabbage: Forty four percent cabbage farmers sprayed powder fungicides to a total area of 4.7951 ha with 6.59 kg/ha during DS and 65% farmers applied an amount of 7.76 kg/ha on 6.6996 ha during WS. Liquid fungicides were also used by only 9% farmers only during WS with 4.96 l/ha to an area of 0.2683 ha.

The most common fungicide used was copper oxychloride for both seasons.

Potato: All potato farmers applied powder fungicides in both seasons with an amount of 38.06 kg/ha to an area of 19.4568 ha (DS). It decreased to 33.54 kg/ha with an area of 7.6902 ha (WS). During DS, only 6% of potato farmers applied liquid fungicide with 0.81 l/ha to an area of 5.2603 ha. This increased during WS (29% farmers) to 7.96 kg/ha with an area of 2.5176 ha.

The most common fungicides used were Cymoxanil+mancozeb and Mancozeb for both seasons.

Other crops: The dominant fungicide used for Chinese cabbage, carrot and celery was Mancozeb. There was no liquid fungicide applied in both seasons. Only during DS celery received 21.90 kg/ha on 0.042 ha. Fungicide application to Chinese cabbage (67% farmers) and carrot (86% farmers) were 6.44 kg/ha (area = 0.2112 ha) and 18.56 kg/ha (area = 1.5522 ha) during DS, respectively. Seventy-eight percent of Chinese cabbage farmers and 47% of the carrot farmers applied fungicides during WS with the amount of 8.0 kg/ha on 0.2112 and 0.9098 ha, respectively.

Herbicides. Not more than 22% of all farmers applied herbicides for both seasons and only Glyphosate (liquid herbicide) and Linuron (powder herbicide) were used for cabbage, potato and carrot for both seasons.

During DS, cabbage fields (0.8658 ha) were sprayed with 3.15 l/ha (Glyphosate) by 12% cabbage farmers during DS which increased tremendously during WS to 33.19 l/ha on 0.1356 ha by 3% farmers.

Most carrot farmers (86%) sprayed their fields during DS with 3.41 kg/ha (only Linuron) on 0.9572 ha. During WS (60% farmers) the amount of herbicide decreased to 1.75 kg/ha with an area of 1.1168 ha in WS.

Only 1 potato farmer applied herbicide during DS with 1.74 kg/ha on 0.1729 ha whereas 2 farmers used it with 8.35 l/ha on an area of 0.4193 ha during WS.

Stickers. Surfactant and Toxanon+oil were normally used as sticker especially for cabbage, potato, carrot and Chinese cabbage. Forty percent and 35% of all farmers used sticker during DS and WS, respectively.

Fifty two percent of cabbage farmers used sticker with an amount of 3.70 l/ha during DS. This increased during WS to 4.42 l/ha used by 21% of the cabbage farmers.

During DS, potato plants received 12.17 l/ha of sticker from 39% potato farmers. This increased to 22.55 l/ha during WS (26% of the potato farmers).

Only in carrot the application of sticker decreased in WS from 3.11 l/ha (DS) to 1.64 l/ha.

There was no application of sticker during DS in Chinese cabbage but only during WS with an amount of 0.43 l/ha.

Growth regulator (Gibberellic acid) was used only by one respondent for potato during DS with an amount of 0.10 l/ha.

ECONOMIC ANALYSIS

This part of the volume aims to present an economic analysis based on

- the demographic data of the farmer-respondents and their farms
- credit sources, usage and interest rates;
- variable production costs per crop and their percentages out of total variable cash costs;
- gross margin analyses for major crops and labor input for certain farm operations and per cropping season.

1.0 DEMOGRAPHIC INFORMATION

Respondents from Benguet and Mountain Province can be characterized by being male, belonging to the Kankaney tribe, 30 - 39 years old, have 5 - 8 years of schooling, have devoted 6 - 10 years of their lives to farming, and have been operating independently a farm for 1 to 5 years.

As for the characteristics of their farms, they were mostly under 1 hectare; owned by the farmers themselves; were located in average 53.39, 73.54, 0.10, 2.20, and 0.30 kilometers away from the input source, output market, feeder road, main road and water source, respectively; and mostly irrigated by the sprinkler method during the dry season and unirrigated during the wet season.

2.0 CREDIT SOURCE, AMOUNT AND INTEREST RATES

Considering both seasons, the average amount borrowed in 1989 was ₱18,629, borrowed at an average cost of money of 21%, payable after harvest. The range of the amount borrowed was from ₱2,000 (from a foundation) to almost ₱60,000 (from a bank/dealer).

Dry season: Thirty three (77%) out of the 43 respondents borrowed money to finance farm operations during dry season. As to the source and amount of credit, those who borrowed resorted to

private money lenders (46%; 18%)[1], bank/dealer (15%; 60%), relatives (7%; 11%), co-farmers (7%; 10%), farm input supplier (7%; 16%) and others (18%; 23%). The average amount of credit was ₱23,773, borrowed at an average interest rate of 23%.

Wet season: During WS, 29 (57%) of the 51 respondents of this season had to borrow money. The credit sources were private money lenders (36%; 23%), co-farmers (12%; 5%), neighbors (11%; 0%), bank/dealer (11%; 104%), businessmen (10%; 23%), and others (20%; 13%). The average amount of credit during this season was ₱12,776, borrowed at an average interest rate of 18%.

3.0 QUANTITATIVE YIELD ANALYSIS

A lot of the farmers suffered yield losses up to 100% for some of their crops (Table 7-9). This is specially true for the wet season when for instance 15% of the cabbage growers could not achieve any yield at all and an additional 41% had almost total loss with yields of less than 20% of the possible amount. The situation in case of potato can be described as only slightly better. The most dominant reason for these bad yield figures were natural calamities (e.g. typhoons, frost, etc.) that took place during the later part of 1989.

Cabbage: In DS only 6 out of 25 cabbage growers achieved a good yield with adjusted yield figures[2] of 45 to 66 t/ha. An additional 6 farmers harvested between 22 to 41 t/ha whereas 12 farmers achieved less than 33% of the potential yield. Out of the latter the yield of 8 farmers can be described only as almost-total-losses with less than 10 t/ha. One farmer could not state a harvest at all in DS.

The situation was worse in WS when 5 out of 34 cabbage growers had total losses and 15 almost-total-losses with figures of less than 10 t/ha. Nevertheless, 5 farmers could record a good harvest with yield figures between 33 and 46 t/ha.

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1. 46% = percentage of total money borrowed during DS; 18% = provision payable after harvest

2. computed on a per hectare basis

Table 7. Yield and sales value of cabbage in DS & WS (1989)*

Dry Season						Wet Season						
Resp. No.	Utilized area (ha)	Yield (kg)	Sales value (₱)	Adjusted** (kg/ha)	Price per kg	Resp. No.	Utilized area	Yield (kg)	Sales value (₱)	Adjusted** (kg/ha)	Price per kg
3	0.3854	25367	161950.00	65820	6.38	31	0.8341	38656	67828.00	46345	1.75
6	0.4151	23932	128336.70	57654	5.36	32	0.0231	935	7298.00	40476	7.81
29	0.1410	7600	44058.25	53901	5.80	13	0.1356	5200	7590.00	38348	1.46
4	0.3064	16174	127291.60	52787	7.87	2	0.1440	4900	20200.00	34028	4.12
49	0.1138	5348	47785.00	46995	8.94	46	0.5602	18806	116149.70	33570	6.18
7	0.1400	6321	27616.40	45150	4.37						
56	0.3354	13766	95502.10	41044	6.94	47	0.0423	800	2400.00	18913	3.00
14	0.2252	8789	59233.40	39028	6.74	52	0.2069	3513	17038.90	16979	4.85
1	0.1514	5521	15513.00	36466	2.81	48	0.3057	4750	51801.00	15538	10.91
28	0.1211	3522	15164.00	29083	4.31	50	0.0506	665	10320.00	13142	15.52
54	0.3549	9400	50810.00	26486	5.41	4	0.3814	4882	11992.20	12800	2.46
17	0.1075	2447	19002.00	22783	7.77	36	0.3921	5000	13550.00	12752	2.71
						42	0.2783	3400	50250.00	12217	14.78
8	0.5097	9100	44200.00	17854	4.86	28	0.0209	231	1848.00	11053	8.00
35	0.1414	2042	14434.00	14441	7.07	43	0.8525	9182	86108.45	11029	9.38
2	0.2671	3800	10200.00	14227	2.68	35	0.4689	4550	34005.00	9704	7.47
46	0.5817	7270	72160.00	12498	9.93	26	0.1738	1591	8157.60	9154	5.13
39	0.2816	2200	36800.00	7813	16.73	33	0.2315	1817	28153.90	7849	15.49
21	0.2957	1400	13300.00	4735	9.50	49	0.1870	1400	2520.00	7487	1.80
10	0.2206	958	3303.00	4343	3.45	25	0.1511	916	9472.00	6062	10.34
11	0.1151	440	1367.55	3823	3.11	8	0.1877	1110	9130.00	5914	8.23
25	0.1122	300	2550.00	2674	8.50	30	0.2204	1245	7525.00	5649	6.04
45	0.4304	860	2150.00	1998	2.50	44	1.5837	8800	65350.00	5557	7.43
23	0.9415	1534	8434.00	1629	5.50	3	0.6228	2232	9776.70	3584	4.38
12	0.2443	300	1050.00	1228	3.50	15	2.3117	6525	46315.00	2823	7.10
22	0.0952	n.r.	n.r.	n.r.	n.r.	56	0.0749	191	1797.00	2550	9.41
						22	0.2584	600	1260.00	2322	2.10
						21	0.0916	200	1800.00	2183	9.00
						5	0.5603	1200	17000.00	2142	14.17
						27	0.0561	23	230.00	410	10.00
						7	0.1012	n.r.	n.r.	n.r.	n.r.
						24	0.1902	n.r.	n.r.	n.r.	n.r.
						29	0.0896	n.r.	n.r.	n.r.	n.r.
						34	0.3861	n.r.	n.r.	n.r.	n.r.
						37	0.5168	n.r.	n.r.	n.r.	n.r.

* The yield computed (adjusted) on a per hectare basis is grouped in good yield (66 - 100%), medium yield (33 - 65%) and bad yield (total loss - 32% of
** computed on a per hectare basis
*** n.r. means no yield recorded = total loss

Table 8. Yield and sales value of potato in DS & WS (1989)*

Dry Season

Resp. No.	Utilized area	Yield (kg)	Sales value (P)	Adjusted** (kg/ha)	Price per kg
39	0.0430	1900	15500.00	44186	8.16
17	0.2376	9650	78750.00	40614	8.16
21	0.1662	6700	36996.00	40313	5.52
2	0.1347	5100	28999.00	37862	5.69
34	0.2390	9000	39920.00	37657	4.44
33	0.1615	5778	14204.00	35777	2.46
36	0.5785	18280	176595.00	31599	9.66
11	0.3975	11110	65264.70	27950	5.87
43	0.8325	19510	158965.00	23435	8.15
22	0.5233	12055	86673.50	23036	7.19
42	0.3659	8193	60676.80	22391	7.41
7	0.1579	3435	22110.00	21754	6.44
24	0.3430	7366	66703.00	21475	9.06
31	0.6799	13100	63200.00	19268	4.82
27	0.0561	1035	4999.00	18449	4.83
13	0.7141	13039	88765.00	18259	6.81
4	0.7432	13552	129187.00	18235	9.53
49	0.0413	750	4410.00	18160	5.88
28	0.1013	1660	58278.00	16387	35.11
25	0.2675	4105	31272.50	15346	7.62
14	0.1729	2594	21874.80	15003	8.43
15	0.7757	41073	403957.90	14797	9.84
37	0.6767	10000	74000.00	14778	7.40
6	0.0773	1078	8737.00	13946	8.10
10	0.2096	2901	29990.20	13841	10.34
32	0.6233	8369	84632.00	13427	10.11
23	0.1935	2180	16860.00	11266	7.73
12	0.1344	1400	14700.00	10417	10.50
26	0.3510	13391	154390.75	9912	11.53
29	0.0979	930	3810.00	9499	4.10
1	0.0481	450	2430.00	9356	5.40
30	0.2733	1742	12291.00	6374	7.06
44	0.5658	9000	62000.00	5748	6.89
35	0.7844	4125	21180.00	5259	5.13
3	0.2050	1000		4878	0.00
45	0.4653	999	8491.50	2147	8.50

Wet Season

Resp. No.	Utilized area	Yield (kg)	Sales value (P)	Adjusted** (kg/ha)	Price per kg
55	0.6699	52890	95610.00	78952	1.81
23	0.0057	300	1210.00	52632	4.03
13	0.4510	18994	105860.00	42115	5.57
15	0.0449	1869	17945.00	41626	9.60
24	0.3129	5440	30495.06	17386	5.61
48	0.2428	3650	18000.00	15033	4.93
52	0.2146	3220	27960.00	15005	8.68
22	0.0701	1040	9375.00	14836	9.01
31	0.0960	1308	12783.00	13625	9.77
2	0.2695	3500	15899.00	12987	4.54
51	0.1115	1394	10104.50	12502	7.25
25	0.1304	1569	8971.90	12032	5.72
7	0.0502	600		11952	0.00
17	0.2731	3000	25600.00	10985	8.53
18	0.1720	1600	10880.00	9302	6.80
11	0.2129	1963	13678.00	9220	6.97
26	0.4577	4170	15120.00	9111	3.63
10	0.2111	1800	10799.00	8527	6.00
56	0.2064	1668	13289.00	8081	7.97
49	0.0317	250	1000.00	7886	4.00
39	0.2177	1609	11924.00	7391	7.41
54	0.3549	2600	19680.00	7326	7.57
12	0.8917	6505	33873.00	7295	5.21
42	0.0876	425	2962.50	4852	6.97
21	0.2957	1250	11750.00	4227	9.40
9	0.1319	550	1225.00	4170	2.23
45	0.1205	400		3320	0.00
47	0.3036	1000	5800.00	3294	5.80
14	0.1469	400		2723	0.00
6	0.0446	100		2242	0.00
8	0.0695	100		1439	0.00

* The yield computed (adjusted) on a per hectare basis is grouped in good yield (66 - 100%), medium yield (33 - 65%) and bad yield (total loss - 32% of

** computed on a per hectare basis

Comparing the adjusted yields of the different seasons it must be noted that what is listed as good yields in WS reached only the level of medium yields in DS.

Potato: In respect of quantity potato growers experienced the opposite situation. Good yields in WS reached about the double amount per hectare compared to the yields which were achieved in DS. Nevertheless, the distribution of adjusted harvest[1] into the three categories (good, medium and bad yield) are similar to the one for cabbage. Only 8 farmers achieved good yields in DS, whereas 13 stated medium and 15 bad yields. There was no total loss in DS even that 5 farmers produced less than 20% (< 8837 kg/ha) of the highest recorded adjusted yield per hectare.

In WS the situation worsened. Even that - as mentioned above - the highest yields were almost double of that of DS there were only 2 farmers each in the groups of good and medium yield whereas 27 reached only bad yields with adjusted figures similar to the ones in DS. Also in WS no farmer had to state total loss for potato.

Minor crops: Among the minor crops carrot and Chinese cabbage should be mentioned. Farmers growing these crops had a much higher yield (carrot: 3x; Ch.cabbage: 2x) in WS than in DS. Nevertheless, it must be noted that growing these two crops in WS is bearing the risk of considerable yield losses or - especially in case of carrot - of total loss.

1. computed on a per hectare basis

Table 9. Yield and sales value of carrot, Chinese cabbage, radish and sweet peas in DS & WS (1989)*

Dry Season						Wet Season					
Resp. No.	Utilized area	Yield (kg)	Sales value (P)	Adjusted** (kg/ha)	Price per kg	Resp. No.	Utilized area	Yield (kg)	Sales value (P)	Adjusted** (kg/ha)	Price per kg
Carrot						8	0.0439	4800	37800.00	109339	7.88
13	0.5275	15570	121700.00	29517	7.82						
19	0.2449	5800	43500.00	23683	7.50	23	0.0283	1500	3810.00	53004	2.54
46	0.2380	5000	52400.00	21008	10.48						
28	0.0323	660	3000.00	20433	4.55	19	0.3313	4500	25500.00	13583	5.67
						20	0.2229	2500	7500.00	11216	3.00
20	0.0786	850	5200.00	10814	6.12	49	0.0225	225	450.00	10000	2.00
						29	0.1410	1000	7475.00	7092	7.48
30	0.0309	160	720.00	5178	4.50	52	0.1199	650	2050.00	5421	3.15
39	0.0690	n.r.	n.r.	n.r.	n.r.	56	0.0992	482	1486.00	4859	3.08
						47	0.0957	300	855.00	3135	2.85
						6	0.1678	n.r.	n.r.	n.r.	n.r.
						7	0.0346	n.r.	n.r.	n.r.	n.r.
						9	0.0952	n.r.	n.r.	n.r.	n.r.
						13	0.1555	n.r.	n.r.	n.r.	n.r.
						17	0.0323	n.r.	n.r.	n.r.	n.r.
						25	0.0331	n.r.	n.r.	n.r.	n.r.
Chinese cabbage											
19	0.0745	2600	7000.00	34899	2.69	50	0.0330	9061	26439.00	274576	2.92
20	0.1367	3785	4362.50	27688	1.15						
						52	0.1411	4600	13050.00	32601	2.84
39	0.1877	n.r.	n.r.	n.r.	n.r.	55	0.2420	5000	15000.00	20661	3.00
						51	0.1115	2000	10380.00	17937	5.19
						22	0.0889	1400	11150.00	15748	7.96
						17	0.0323	500	1000.00	15480	2.00
						21	0.2009	1600	6445.00	7964	4.03
						7	0.0410	300	600.00	7317	2.00
						1	0.1075	n.r.	n.r.	n.r.	n.r.
						Radish					
						26	0.0336	450	1140.00	13393	2.53
						9	0.1540	1800	2700.00	11688	1.50
						56	0.0196	200	600.00	10204	3.00
						11	0.0984	418	2090.00	4248	5.00
						32	0.2502	n.r.	n.r.	n.r.	n.r.
						Sweet peas					
						29	0.2334	480	11176.00	2057	23.28
										603	38.02
						28	0.1095	66	2509.00	282	14.44
						9	0.0638	18	260	192	29.00
						25	0.0261	5	145.00		
						Lettuce					
						55	0.2528	600	1800.00	2373	3.00
						String bean					
						55	0.1623	232	1160.00	1429	5.00

* The yield computed (adjusted) on a per hectare basis is grouped in good yield (66 - 100%), medium yield (33 - 65%) and bad yield (total loss - 32% of

** computed on a per hectare basis

4.0 COSTS AND RETURNS AND COST COMPONENTS ANALYSIS

This chapter tries to analyze the cost and returns based on the different crops. Non-cash costs like family labor, interest on operating capital and on borrowed money are not put into consideration for the analysis.

As for the costs and returns analysis, the crop that was found to be the most profitable (considering only successful croppings) during DS was cabbage while during WS, it was Chinese cabbage. On the other hand to grow celery and/or stringbeans in DS resulted in loss of money for all farmers concerned because of total crop loss. The same applies during WS for potato which still produced yield but received more cash input than what could be derived by selling the product in the market.

The average profits for the different crops per hectare are given below in Table 10. Family labor and interest payment are not counted in these figures:

Table 10. Average cash income for the most important crops

Dry season:	Cash returns	-	Cash costs	=	Cash income
Cabbage:	₱156,865/ha		₱ 73,529/ha		₱ 83,335/ha
Potato:	₱129,272/ha		₱103,300/ha		P=25,972/ha
Carrot:	₱107,670/ha		₱ 55,990/ha		P=49,679/ha
Ch. cabbage:	₱ 62,860/ha		₱ 48,319/ha		P=14,541/ha
Wet season:	**Cash returns**	**-**	**Cash Costs**	**=**	**Cash income**
Cabbage:	₱ 79,715/ha		₱ 72,305/ha		₱ 7,410/ha
Potato:	₱ 78,326/ha		₱127,342/ha		- ₱ 49,016/ha
Carrot:	₱135,591/ha		₱ 62,776/ha		₱ 72,815/ha
Ch. cabbage:	₱156,909/ha		₱ 73,500/ha		₱ 83,409/ha

As for the specific cash costs (in ₱) per crop they are listed in Table 11:

Table 11. Cash costs of different crops

Dry Season	Cabbage	Potato	Carrot	Ch. Cabbage
Seeds/Tubers	6,895	36,495	7,216	1,273
Fertilizer	17,723	18,786	12,328	12,767
Insecticides	13,588	1,286	1,025	3,060
Fungicides	1,176	9,957	503	951
Herbicides	188	26	1,085	-
Stickers	150	210	66	-
Gr. regulators	-	19	-	-
Labor costs	15,546	25,521	24,010	28,884
Market'g costs	18,263	11,000	9,757	1,384
Total:	**73,529**	**103,300**	**55,990**	**43,319**
Wet Season	**Cabbage**	**Potato**	**Carrot**	**Ch. Cabbage**
Seeds/Tubers	9,060	53,547	6,765	4,369
Fertilizer	25,798	20,871	12,475	16,828
Insecticides	6,916	1,006	783	8,520
Fungicides	2,080	11,741	2,400	1,675
Herbicides	746	349	1,198	-
Stickers	53	141	60	6
Labor costs	17,967	29,803	24,854	6,667
Market'g costs	9,685	9,829	14,242	35,435
Miscellaneous	-	55	-	-
Total:	**72,305**	**127,342**	**62,777**	**73,500**

The variable cash cost composition analysis for the "high-net-loss" crop potato for both seasons shows that tubers comprised around 35% of total cash costs. It was followed by hired labor (25%), fertilizer (18%), marketing costs (11%) and fungicides (10%). In comparison to other crops hired labor and the use of fungicide was the dominant cost component during 1989 which made potato production unsuccessful.

Comparing the different crops in respect of percentage of cash costs for pesticides the data show the following:

Table 12. Cash costs for pesticides and percentage based on all cash costs

Cabbage:	DS	21%	=	₱15,102/ha;	WS	14%	=	₱ 9,795/ha
Potato:	DS	11%	=	₱11,479/ha;	WS	10%	=	₱13,237/ha
Carrot:	DS	5%	=	₱ 2,679/ha;	WS	7%	=	₱ 4,440/ha
Ch. cabbage:	DS	9%	=	₱ 4,011/ha;	WS	14%	=	₱10,202/ha

For cabbage and Chinese cabbage, pesticide cost was largely comprised of insecticide costs whereas for potato fungicides and for carrot insecticides and herbicides had the biggest share.

As for the non-cash costs (e.g., unpaid family labor, interests on operating capital and capital investment, depreciation and land rent), it was family labor which was consistently the largest component of non-cash, as well as total costs. In almost all cases, family labor constituted the highest "financial" input for crop production.

If we include non-cash costs (family labor = ₱50/MD; 7.5% opportunity cost provision for personal and borrowed money as well as for capital assets [tools and equipment]; depreciation; opportunity cost for land rent: ₱3,000/ha) we must state that no crop produced a positive net income in both seasons during the period of survey. But we must consider that the yields of individual farmers differed widely (obviously due to natural calamities) and the average figures do not allow us to state any conclusion about the profitability of the individual crops.

Potato, even based on only the successful croppings, was the crop which proved to be a financial failure during both seasons with - ₱77,524/ha [DS] and - ₱227,437/ha [WS]. Only if family labor and other non-cash costs are not counted, farmers could make an income (₱33,744) in DS. But it has to be taken into account that this figure has not yet considered interest payment for borrowed money.

5.0 FARM INCOME ANALYSIS

The average profit of the respondents during DS was ₱17,702 or computed per hectare utilized ₱54,639/ha. However, it has to be considered that 16 farmers out of 43 (37%) produced with loss during this season, ranging from ₱1,029 to ₱54,872 during DS.

If family labor and other non-cash costs were counted, only 11 respondents (representing 26% of the total) had positive net income figures.

As for WS, only 16 respondents (representing 31% of the total) had a positive net cash income. The majority (69%) of the farmers made loss during this season reaching as high as ₱118,106 or in terms of hectarage ₱228,534/ha. As for the net income, only 3 respondents (representing 6% of the total) had a positive per hectare net income.

The average net cash income, per hectare net cash income, net income and per hectare net income were all negative: - ₱9,417, - ₱24,853, - ₱64,940 and - ₱264,346, respectively. This result is understandable, considering the yield losses during WS caused by natural calamities.

Concerning the cropping pattern the data show that any combination with carrot will give the highest net cash income. The second best combination was cabbage/potato which was used by most of the farmers (46%) during DS but only by 12% during WS.

During WS, the three-crop-combination planters claimed the only positive average cash profit ₱5,425 or ₱21,139/ha. The cabbage mono-crop farmers, which comprised the largest group, incurred one of the largest average net cash losses figuring - ₱14,245 which means computed per hectare a loss of - ₱26,498/ha. It is interesting to note that extensive diversification of planted crops (2 farmers planted 5 crops during WS) did not result in a higher income but in the highest total cash loss.

6.0 Labor input analysis

Results revealed that based on the combined dry and wet season figures, carrot, potato, and cabbage, in that order, were the most labor-intensive crops. Potato (658 MDs per hectare) was in general the most labor-intensive vegetable followed by cabbage with 583 MDs. For carrot the amount for labor input depends very much on the season with

294 MDs per hectare during the DS and 1948 MDs per hectare during WS, the latter caused by time-consuming thinning. In general, for carrot much labor input was involved in seedling treatment, weeding and thinning; for potato, dehaulming and for cabbage, soil treatment.

7.0 Implications of the results

The following implications for further project activities were derived from the results of the study:

1) The introduction of biological technology could be most probably adopted with enthusiasm on the part of the farmers as most of them are young and relatively new in farming;

2) Any program or project must consider the educational level of the farmers which requires an easily understandable approach;

3) Production risks, especially during the wet season, are high, so the production risk and the cost of production should not be further increased through the program or project;

4) All proponents would do well to look into how the high cost but probably less critical production components could still be lowered without sacrificing yield quantity and quality (e.g., insecticides and fungicides); and

5) Any technology should be less labor-intensive than the present crop production method, since the survey reveals that a substantial portion of the producton costs is comprised of hired and family labor costs.

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8.0 Glossary for the economic analysis report

1) ***cash income/loss:*** either returns or losses which are derived by subtracting cash costs from cash returns

2) ***cash costs:*** are expenditures for which actual money outlays are involved (e.g., fertilizer, hired labor, and marketing costs)

3) ***cash returns:*** are income or proceeds from goods sold

4) ***net income/loss:*** are either returns or losses which are derived by subtracting total costs from total return;

5) ***total costs:*** is equal to the total of cash and non-cash costs

6) ***non-cash costs:*** primarily refers to "self-owned, self-employed resources" used by a farmer in his production process; the costs which do not involve cash outlay but nevertheless have opportunity costs such as unpaid family labor, interests on operating capital and capital investment, depreciation and land rent

7) ***total returns:*** is equal to the total of cash and non-cash returns

8) ***non-cash returns:*** refers to the value of the produce of farmers not sold but used for succeeding production activities, consumed at home, used as payment in kind, given away to relatives/neighbors, used as reserve or stock, etc.

9) ***unadjusted income/loss:*** are either actual income or losses, without taking into consideration the land area(s) of the farmer(s)

10) ***adjusted income/loss:*** income or losses on a per hectare basis derived by dividing the actual income or losses by the farm areas

11) ***opportunity cost:*** income that could have been received if an input or package of inputs had been used in its most profitable alternative use

12) ***unpaid fammily labor:*** is equal to the number of man-day (MD) devoted by family members (including the farmer himself), relatives and/or friends involved in production multiplied by the minimum wage (₱50/MD in 1989) for

agricultural workers for the particular area and year under survey

13) ***interest on operating capital:*** is equal to the total cash costs multiplied by the opportunity cost of capital (occ); the occ could be the commercial banks' savings rate or the lending interest rate in the surey area

14) ***interest or capital investment:*** is equal to occ multiplied by the average inventory; average inventory is equal to the sum of the beginning and ending inventory divided by 2

15) ***ending inventory:*** is equal to beginning inventory minus accumulated depreciation

16) ***depreciation:*** loss or decline in the value of a fixed asset because of wear and tear, obsolescence or the mere passage of time; was computed by using the straight line method where:

$$\text{Annual depreciation} = \frac{\text{cost-salvage value}}{\text{useful life of asset}}$$

salvage or remaining value of all assets at the end of their useful life were assumed to be 0

17) ***accumulated depreciation:*** is the product of annual depreciation and the period the asset had been used

18) ***land rent:*** opportunnity cost of land; was approximated by considering the rental value of land in the survey area

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