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SUSPER

BASELINE CHARACTERIZATION OF URBAN AND PERI-URBAN VEGETABLE PRODUCTION IN PHNOM PENH

Em Huy (MAFF) and Paule Moustier (CIRAD)
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	▪ University of Agriculture and Forestry, HCMC, Vietnam

c/o: Vien Nghien cuu Rau qua – Trau Quy – Gia Lam – Hanoi – Vietnam
Tel: 844-876 82 87 Fax: 844-827 61 48 – Email: susper@vnn.vn
Website: www.avrdc.org/susper

FOREWORD

This work takes place within the first component (Analysis of Peri-urban Production Systems) of the regional Avrdc-Cirad "Sustainable Development of Peri-urban Agriculture in South-east" Asia (Susper) project. It has received guidance from Mubarik Ali (AVRDC), Paule Moustier (CIRAD), Mr Srun Sokhom (MAFF of Cambodia), and Boun-Tieng Ly (French Ministry of Foreign Affairs) who has contributed in editing the report.

ABSTRACT

The main objective of the study is to appraise the constraints and opportunities of farmers in relation with their location in urban and peri-urban areas (land pressure, markets, labour, etc). Some secondary data was gathered about vegetable production in Phnom Penh and surrounding provinces. Interviews with resource persons, and some field visits were organized, to review the state of available information. A farm survey was conducted on a sample of 397 farmers distributed in Mean Chey, Dangkor, Russey Keo, Kien Svay and Saang – that is 149 farms in the urban districts and 248 farms in the peri-urban districts. In the sample, 13 farms do not grow vegetables.

In 2002, Phnom Penh had an estimated population of 1,191,668 heads. Out of a population of 980,003 people in 2001, 353,096, i.e., 37%, were farmers. The different farming areas have been identified and mapped, in particular, in Phnom Penh and Kandal municipality which supply the bulk of vegetables to Phnom Penh.

The suitable seasons for cropping in Urban and Peri-urban areas are the wet season from May/June to August/September and the dry season from November/December to end to March/April. The crops grown by farmers are very diversified (more than 40 crops quoted by farmers, including 30 vegetables). The major vegetables are: cucumber, petsai, Chinese kale, lettuce and cauliflower. Vegetable farmers earn much higher incomes than non vegetable farmers; and incomes in peri-urban areas, where land size is higher, are also higher than in urban areas. Crop yields and use of manure are low.

The major constraints, quoted by more than half farmers, are, by order of importance: marketing problems, input costs, land shortage, floods and water shortages.

The survey shows some differences in the farm characteristics according to the districts. Dangkor is a specific district as it has more rice growing, more sandy land, less floods but more water shortages. Saang has more diversified crops than the other districts. Kien Svay is a district with average characteristics relative to the other ones, in particular in terms of water shortages and floods. Kandal (Saang and Kien Svay) districts are more suitable for vegetable production than urban districts (Phnom Penh) because of water sources (river/lake) and less constraints on land (when not considering Dangkor in the comparison of land constraints).

To develop agricultural potential, irrigation systems should be improved to ensure water for cultivation. Additionally, proper agricultural technologies should be launched at the village level to enable less seasonal cultivation in and around Phnom Penh.

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I OBJECTIVES

The main objective of this study is to appraise the constraints and opportunities of farmers in relation to their location in urban and peri-urban areas, and the related land access, pollution sources, markets, labour, etc. We consider as urban production the production inside Phnom Penh municipality, the boundaries of which extend from 15 to 20 kilometers of PP center. Peri-urban production mostly corresponds to Kandal Province, which provides the bulk of Phnom Penh supply (Moustier, 2002; Sokhen et al, 2004).

II REVIEW OF AVAILABLE DATA

A. General data on Phnom Penh

In 2002, Phnom Penh had an estimated population of 1,191,668 heads (out of the total population of Cambodia of 13,040,668, i.e. 9%), from the projection of 1998 population census. The growth rate was 3.5% per year[1]. In 2001, the city covered an area of 375 km² and the population density was 2624 heads/km² (source: website of Phnom Penh department of agriculture), while in Kandal province the density was 301 heads/km² in 2002 (Bureau of urban affairs, 2004). The city includes 4 urban "khans" or districts, without agricultural areas, and three peri-urban districts with agricultural areas, i.e., Russey Keo, Dangkor and Mean Chey[2] (Bureau of Urban Affairs, 2004). Out of the area of 375 km², in 2001, 264 were covered by human settlements (70%), 80 km² (21%) by agriculture, 29 km² (8%) by water, and the rest was not in use. Out of a population of 980,003 people in 2001[3], 353,096, i.e., 36.77%, were farmers; 14,076, i.e., 1.4% were fishermen and 541,201 (i.e. 55%) were traders, the rest (75630, i.e.7.7%) being civil servants (website department of agriculture of Phnom Penh)[4].

[1] In the website of MAFF/Phnom Penh department of agriculture, a growth rate of 1.05% is indicated, which is different from the data of the population census.
[2] In the report, we will refer to these districts as urban, while peri-urban districts will refer to Kandal province districts.
[3] This figure, in MAFF/Phnom Penh website, is different from the data of Population Census, indicating 1,152,572 people in 2001.
[4] There are various difficulties in using this data. The total is 984003 and not 980,003. The method used to get this information is not specified. The category "traders" may encompass all the workers in services in

B. Agricultural areas

A review of existing data has been conducted by Moustier (2002) and we insert below extracts of this report. "According to the statistics of the ministry of agriculture, the total area cultivated in Phnom Penh municipality in 2001 was 7500 hectares of rice and 765 hectares of vegetables. In the rainy season, the vegetable cultivated area is 465 hectares only, including 122 hectares of leafy vegetables, 83 hectares of watermelon, 71 hectares of cucumber, 12 hectares of tomato (see Table 1). Kohkloung Island (Chamcar Maun District) is a big production area with 73 hectares of specialized vegetable production, employing 200 families but this is mostly outside the rainy season which extends from May to October.

The three most important districts producing vegetables in all seasons are by order of importance: Dangkor (South), Russey Keo (North), Mean Chey (South). Kandal Province is the most important area in terms of the vegetable market supply. The largest district in terms of vegetable production is Saang district (2500 hectares), located around 40 kilometers from Phnom Penh. The second one is Kien Svay (1000 hectares of vegetables), located 25 kilometers from the city (see figure 1).

Table 1-Some data on crop production in Phnom Penh in 2001

Crop	Area (hectares)
Rice	7500
Vegetables	765
Vegetables (rainy season)	465
Including	
Leafy vegetables	122
Watermelon	83
Cucumber	71
Tomato	12

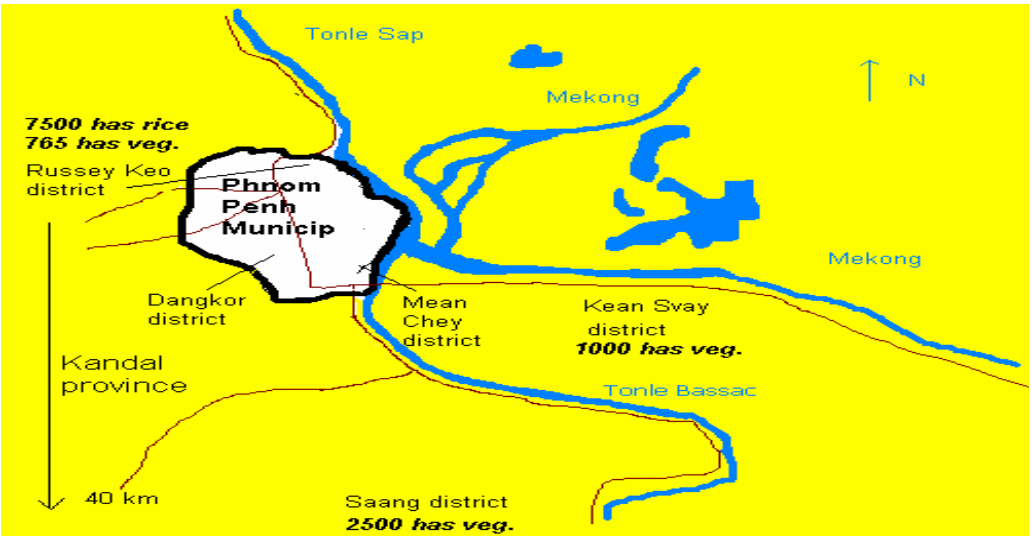
Source: Phnom Penh department of agriculture, quoted in Moustier (2002)

In Mean Chey district there is a specific production of 35 hectares of water convolvulus in the wastewater basin (Boeung Tumpon). 838 families of fishermen work them. Water convolvulus is harvested every 15 days, total production is estimated at 18 tons/day[5].

industry, so that the total covers all the category of work. Besides, the total Phnom Penh population should be higher than the sum of all labour categories, as it includes non active persons.

[5] Source: communication of Mr Phat Leng (head of agro-industry department) in 2001. These aquatic systems are investigated by EU-funded Papussa project (www.papussa.org)

Figure 1 – Location of the main vegetable producing districts around Phnom Penh



Source: data from department of agriculture, Phnom Penh (map done by P. Moustier, SUSPER)

Similar data are not available for vegetables, but the reader can refer to Susper-component 2 data on the coverage of vegetables available in Phnom Penh markets by Phnom Penh and Kandal agriculture: Phnom Penh municipality provides more than 98% of kangkong, while Kandal provides more than 70% of cucumber, yard long bean and choysum (or pakchoi). Out of a total of 90.4 tons of vegetables traded per day (including seven major vegetables consumed fresh in Phnom Penh), 37 tons are imported (40%), 37 tons are from Kandal province, including 17 tons of cucumber and 10 tons of choysum (40%), 8.4 tons are from Phnom Penh (9%), including 8.1 tons of kangkong, the rest originates from rural provinces (Sokhen, Dianika and Moustier, 2004; updaded version forthcoming). As regards vegetable consumption in Phnom Penh, the website of the department of agriculture of Phnom Penh provides an estimate of 109.5 kg/capita/year in 2001, i.e., 294 t/day (while the average for Cambodia is 154t/day according to Abedullah and al, 2002), but the source of this information is not detailed.

The bureau of urban affairs conducted an assessment of the rice food balance in 2003, showing that Phnom Penh provides 7% of its own consumption (see table 2).

Table 2-Estimation of rice consumption coverage by Phnom Penh rice production

Population (number)	1,283,355
Cultivated area (ha)	8,164
Harvested area (ha)	8,068
Yield (t/ha)	1.946
Output (t)	15,700
Seeds and losses (t)	2,041
Available output (t)	13,659
Rice consumption (t)	183,520
Food balance (t)	169,860
Food coverage (%)	7

Source: Bureau of Urban Affairs, 2003 quoting The Cambodia Socio-Economic Survey 2002-2003 (National Institute of Statistics, Ministry of Planning). The data on rice consumption corresponds to 190 kg/capita, while the website of MAFF gives a rice consumption of 223 kg/head/year.

As regards livestock, in 2002, 17,105 heads of cattle, 17,652 pigs and 293,073 chickens were recorded by the department of agriculture (bureau of urban affairs, 2004). Meat consumption was estimated at 25 kg/head/year by the department of agriculture website in 2001. In the year 1997-1998, 6,100 tons of production of fish was recorded by the department of fisheries of the ministry of forestry and fisheries (quoted by Bureau of Urban Affairs, 2004). In 2001, the department of agriculture estimated fish consumption at 11 kg/head/year, i.e., 10731 tons of fish per year – if we consider no change in fish production from 1998 to 2001, we have a coverage of 57% of Phnom Penh fish consumption by urban agriculture.

C. Climatic data

The average temperature, rainfall, and humidity for Phnom Penh from 1996 to 2003 were obtained from Pochentong Weather Station. In Phnom Penh, rain always starts falling in April with little intensity, and increases in the following months (see Appendix- Table 33 and Figure 4). Its maximum is generally reached in September and October, with similar amounts in September, October, and November. Rainfall declines from late November to March. It is the monsoon wind blowing down from the South-West which brings rain showering Cambodian territory every year.

The temperatures follow a trend similar to the rainfall (see Appendix-Figure 3). The temperature starts increasing at the same time than the rainfall. It gets cooler from late November to February, during which it decreases from 26-28^{o}C to about 25^{o}C. From March to early May, in the dry season, the temperature increases to reach around 31^{o}C. It goes down again when the rain comes in late May. For the whole year, humidity ranges from 70% to 80% on average (see Appendix- Figure 5).

Floods occur from August to November. The dry season lasts from November to April, with water shortages starting in February which constrains growing until May. This calendar of rainfall and droughts explain that the main vegetable shortages and importations occur in May-June (end of dry season) and October-November (flooding time).

D. Production systems

This section is drawn from Moustier (2002). “The production systems are mostly documented for Kandal province, through Agrisud data (Agrisud, 1999). In Kandal province, the topography and location with respect to the canals (*preks*) are essential to understand the calendar of flooding and the cropping systems. The lowest areas are the ones cultivated the longest with rice, and they also correspond to the poorest families. The areas grown with vegetables are the canal banks and “revers de bourrelets de berge” (*chamcar*). The most favorable period to grow vegetables is the start of rainy season (May to August).

The production systems are very diversified, with the current combination of the following crops in the high lands: on “bourrelets de berge” fruits (banana, coconut, jackfruit, mango); in high *chamcar*, vegetables: chinese kale, Chinese cabbage, cabbage, chives, salad, mustards, chillies, ginger; in low *chamcar* : sweet potato, sugar cane, mungo bean, maize, groudnut, ginger, yam, taro ; in the lowland : rice (in the rainy or dry season), maize, beans (Agrisud, 1999). 30% of families have cattle which are used for ploughing and manure. Pigs are fed with farm and home residues and are used as savings.

The incomes are the highest for the families having access to vegetable plots, which are also the families who can afford investment in agricultural inputs and labor-force. The number of landless families is growing. In five villages surveyed in 2000, 30 to 80% of farms had access to non-farm income including trade, fishing, sale of labor-force (20% of farmers sell their labor-force).

Agrisud project works in two preks of Saang district: Takut and Ong Pang. Agrisud project has tested different solutions to lengthen the production period, nurseries built on stilts to be used in the rainy season and transplant in the beginning of dry season, use of adapted varieties and pesticides, composting), These techniques have been successfully tested by Agrisud pilot programme and have generated numerous technical documents but the main bottlenecks are related to the availability of skilled staff for technical transfer, to access to inputs and to access to water. Agrisud entails an irrigation component with prek upgrading for farmers to be able to irrigate in the late dry season. One problem with access to inputs is the difficulty in assessing the demand for agricultural inputs and so launch enterprises with adequate production plans; another one is the lack of farmers' information about input use. At the moment some producers get their supply from Vietnam or Thailand. Agrisud has trained 100 leader farmers on market gardening techniques, who themselves have trained around 600 farmers.

Compared with production systems in Kandal province, the exploratory farmers' interviews indicate the following trends for Phnom Penh municipality:

- Less diversified production systems, with larger share of vegetables
- Higher share of leafy vegetables in the cropping systems
- Most of families own smaller plots
- Longer period of vegetable cultivation
- More diverse modes of access to water

Since 1989, only rivers and close river banks in Phnom Penh belong to the state, and farmers consider the land they farm as their own and may have them built upon; the World Bank supports the registration of land titles, at the moment 20% of land is recorded. There was no master-plan before early 2005. The state has limited financial resources to protect land, which would involve some purchase of land, compensations, etc[6]. There is contradictory information about the directions of growth of the city, it is likely that it indeed extends in all directions be but? they subject to floods or not (the prime minister wishing an expansion toward the East). Industrialization which has started in 1995 is an important factor of urban development as factories attract new population and markets. The houses encroach on agricultural areas through embankments[7].

The farm plot size and potential, in addition to the livestock ownership, are highly variable according to farmers' financial assets. Large plots are few in the five villages surveyed in Saang district by Agrisud, only 17% of farms were larger than 1.5 hectare. One sixth of farmers grow half of the land. 20% of farmers surveyed by Agrisud in 2000 rent the land; the status of access to land for the rest being unclear. 44% of farmers would like to buy new land and 8% would like to sell (Agrisud, 1999)".

[6] Source : Communication of Chhoun Sothy, director of Cadaster, in 2001

[7] Source : communication of Valerie Deletage (doctoral student in geography, Bordeaux University) in 2001

III SURVEY METHODOLOGY

The available data is quite sketchy in terms of geographical coverage, especially as regards Phnom Penh municipality. Hence a survey was carried out on a sample of 400 farmers in Phnom Penh municipality and Kandal Province, from June to October 2002. The choice of the districts results from the consideration of their importance in market supply (data of Component 2) plus the importance of vegetable production (data from agricultural statistics above). The farmers were randomly selected from five major vegetable growing districts, including 150 farms in Phnom Penh municipality – Mean Chey (50 farms), Dangkor (50 farms) and Russey Keo (50 farms) and 250 farms in Kandal Province (Kien Svay district : 100 farms), and Saang district (150 farms). There were some questionnaires for which the answers were of dubious quality, and finally we kept 397 questionaires distributed as follows: Mean Chey (50), Dangkor (50), Russey Keo (49), Kien Svay (97) and Saang (151) – that is 149 farms in the urban districts and 248 farms in the peri-urban districts. For 58 farms, it was not possible to have any information on crops (these included farms not growing any crop). Besides, in the sample, 11 farms do not grow vegetables.

The survey involved six persons, one person for the supervision and reporting; one technical assistant responsible for data entry and processing; and four enumerators responsible for conducting farmer interviews. There were difficulties met during the survey process including rainfall, floods, farmer's reluctance to answer interviews, and also the necessity to replace the technical assistant.

IV SURVEY RESULTS

A. Family Characteristics

The family characteristics of the sample are indicated in table 3. On average each family consists of 4 members including 2.5-2.8 working members. Family members working off- farm as their main occupation represent 11.6% in urban areas and 14.7% in peri-urban areas. The percentage of time spent on the farm is 71% on average, the lowest being in Saang district (36%) and the highest in Dangkor (70%)[8]. These results are quite opposite to the common vision that off-farm activities are the most developed in urban areas. It would be worth investigating in depth the socio-economic profiles and strategies, as well as the possible sources of income of the farmers located in the different districts.

As regards the education level, most farmers have spent about five years on average at school. Their experience in vegetable cultivation ranges from 15 to 18 years.

[8] In the analysis of production systems in Saang conducted by Agrisud in 2000 (Constant and al, 2000), it was reported that 64% of farms have off-farm income, from trade, fishing or sale of labour, especially in the rainy season.

Table 3-Family characteristics of vegetable producers

Family characteristics	Urban area	Peri-urban area
Total family member (number)	4.0	4.0
Family labor available (number)	2.5	2.8
Family labor working off-farm as main occupation (%)	11.6	14.7
Education		
Operator (years)	5.6	5.3
Male adult (years)	8.0	7.1
Female adult (years)	5.7	5.6
Male children (years)	2.8	2.3
Female children (years)	2.8	2.2
Experience of farmers		
Farming	19.02	13.04
Vegetables	18.28	15.43
Gender of the operator (%)		
Male	93.3	83.4
Female	6.7	16.6

Source: Susper surveys, 2002

B. Access to land

Land size owned by each family does not vary much between urban and peri-urban areas. It ranges from 0.47 hectare (in Peri-urban areas) to 0.60 hectare (in urban areas) on average, divided into two plots. Farm size is the largest in Dangkor where rice fields are more numerous than in the other districts (see section on crops). Apart from Dangkor, plot size is smaller in the urban districts (0.24 ha on average) than in the peri-urban districts (0.47 ha on average). The urban area is especially threatened by city development in the near future. In both Urban and Peri-urban areas, there are not many farmers that have encroached or rented land. The size of land rented in by each family is 0.09 hectare on average in Urban areas and 0.07 hectare in Peri-urban areas; the size of the land encroached is 0.02 hectare in Urban and Peri-urban areas. So the total cultivated area is 0.71 hectare in urban areas and 0.56 hectare in Peri-urban areas (see Table 4).

Table 4- Farm characteristics

Variable	Urban area	Peri-urban area
Number of fragments	1.54	1.75
Owned (hectare)	0.6	0.47
Rented in (hectare)	0.09	0.07
Encroached (hectare)	0.02	0.02
Total	0.71	0.56

Source : Susper surveys, 2002

85% of total land area is owned land. Dangkor is the district with biggest owned land area (1,31 ha on average – with a high standard deviation: 1,11), while Mean Chey and Russey Keo are the districts with the lowest owned land area (0,24 hectare on average) – see table 5. When taking out Dangkor, we find the classical result that land is more limited in urban areas (0.24 ha

on average) than in peri-urban areas (0.47 ha on average). The reasons for higher land availability in Dangkor should be investigated.

Table 5-Size of owned land by district

District	Average land owned (ha)	Standard deviation
Urban		
Dang Kor	1.31	1.11
Mean chey	0.24	0.27
Russey Keo	0.24	0.42
Peri-urban		
Kien Svay	0.47	0.56
Saang	0.48	0.63

Source : Susper surveys, 2002

C. Water Sources for cultivation

There are five sources of water including canal, tube-well, open-well, water-reservoir, and river/lake that farmers use to garden their vegetables/crops (see table 6). Crops are cultivated around these water sources, to make access to water easier, especially in the dry season. Farmers use canals to flow water to their farms or to stock it in reservoirs. Using bucks to carry water for vegetables is commonly observed. Yet most farmers still face water shortages especially during the dry season (February – May) every year. There are 59.1% of Urban families and 45.2% of Peri-urban families meeting water shortage. To deal with this obstacle proper irrigation systems need to be developed, after a preliminary consultation of farmers and water specialists.

Table 6- The sources of water (% of farmers)

Source	Urban area	Peri-urban area
Canal	16.90	37.60
Tube well	10.45	13.30
Open well	12.50	9.50
Water reservoir	27.25	18.85
River / lake	16.80	19.80

Source : Susper surveys, 2002

The water shortages are mostly declared in Dangkor (78% of farmers) and Saang (58%) – see Table 7. In Dangkor, the percentage of farmers without any access to water is the highest (30%). In Mean Chey and Russeykeo, access to tubewell is quite high (66% and 55% respectively), in Kien Svay farmers have access to canal (41%) or well (53%), in Saang to canal (35%), river or lake (43%) – see Table 8.

Table 7-Shortage of water according to district location (% of farmers)

District	No shortage of water	Having shortage of water
Urban		
Dang Kor	22%	78%
Mean chey	32%	68%
Russey Keo	51%	49%
Peri-urban		
Kien Svay	48%	51%
Saang	42%	58%
Average	**47%**	**53%**

Source : Susper surveys, 2002

Table 8- Access to water according to district location (% of farmers)

	No access to water	Access to canal	Access to river/lake	Access to Well	Access to tubewell	Access to water reservoir
Urban						
DangKor	30%	34%	20%	12%	42%	6%
Mean Chey	2%	4%	26%	34%	66%	48%
RusseyKeo	10%	12%	4%	16%	55%	20%
Peri-urban						
Kien Svay	8%	41%	10%	53%	36%	21%
Saang	18%	35%	43%	9%	37%	18%

Source: Susper surveys, 2002

Flood is even a higher obstacle as farmers cannot avoid it and it destroys their crops nearly every year when crops are cultivated with an improper cropping calendar: more than 70% of farmers experience floods (see Table 9). This occurs when the water level of Mekong River increasingly overwhelms from September to early November because of rainfall.

Table 9- Water Status (% of farmers)

Water situation	Urban area	Peri-urban area
Percentage of farmers meeting water shortage	59.1	45.2
Percentage of farmers meeting flood	71.8	72.6

Source : Susper surveys, 2002

Dangkor is the district with the lowest percentage of farms experiencing floods (40%)-see table 10.

Table 10-Flood situation by district (% of farmers)

District	No flood	Flood
Dang Kor	60%	40%
Mean chey	12%	88%
Russey Keo	12%	88%
Kien Svay	17%	83%
Saang	15%	85%

Source : Susper surveys, 2002

These natural obstacles often lead to a seasonal vegetable production and to vegetables being imported from neighboring countries to meet domestic demand (Sokhen, Dianika, Moustier, 2004).

D. Land and soil characteristics

Land in both Urban and Peri-urban areas is dominantly in the form of plain (table 11). This is the case for 86% of farmers in urban areas and 89% of farmers in peri-urban areas, with limited differences between the districts. The rest of farms have a small slope without terrace. The color of soil is dominated by brown. The soil type has been divided into three categories: heavy, medium, and light. Apart from Dangkor, with dominant light soils (for 66% of farmers), the dominant texture is medium. The drainage capacity is the highest for Dangkor (54% of farmers with good drainage capacity) – see Table 11, Table 12 and Table 13. The soil characteristics explain that Dangkor is the district experiencing the most water shortages ok, a cause de la texture and the least floods.

The colour of soil is predominantly brown (for more than 85% of farmers in all districts). The percentage of farmers with brown soil is the lowest in Dangkor (85%) – see Table 14.

Table 11-Land and soil characteristics (% of farmers)

Land form	Urban area	Peri-urban area
Land type		
Slope with terraces	1.5	0.5
Slope without terraces	11.9	8.4
Plain	85.8	89.5
Mountain foot step	0.00	0.00
River bank	0.8	1.6
Drainage		
Good	38.6	26.5
Medium	58.2	73.5
Poor	3.2	0.00
Texture		
Heavy	7.6	0.6
Medium	70.6	97.5
Light	21.8	1.9
Color		
Red	0.00	0.00
Yellow	0.00	0.00
Light brown	7.3	0.4
Dark brown	62.7	99.6

Source: Susper surveys, 2002

Table 12-Soil texture according to districts (% of farmers)

District	Light	Medium
Dang Kor	66%	34%
Mean chey		100%
Russey Keo	12%	88%
Kien Svay		100%
Saang		100%

Source: Susper surveys, 2002

Table 13-Drainage capacity according to districts (% of farmers)

	Good	Medium	Poor
District			
Dang Kor	54%	44%	2%
Mean chey	24%	76%	
Russey Keo	37%	63%	
Kien Svay	18%	81%	
Saang	26%	73%	

Source : Susper surveys, 2002

Table 14-Colour of soils according to districts (% of farmers)

	Brown	Yellow
District		
Dang Kor	85%	15%
Mean chey	98%	2%
Russey Keo	100%	
Kien Svay	99%	1%
Saang	100%	

Source : Susper surveys, 2002

E. Assets and livestock

The common assets possessed by farmers are a house, a bike, a TV, a radio/cassette player (see Table 15). Nearly all the farmers (97%) own their own house. The percentage of assets is slightly lower in peri-urban districts relative to urban districts. Only half the surveyed farmers own motorised transport.

Table 15- Household Assets (% of farmers)

Asset	Urban area	Peri-urban area
Household assets		
House	98.5	96.5
Fan	24.2	10.1
Refrigerator	2.00	0.40
Radio/cassette player	64.4	60.1
Washing Machine	0.70	0.00
Television	85.2	79.4
Bicycle	69.1	69.2
Pick up/truck	2.00	0.80
Motorcycle	55.0	44.8
Telephone	10.7	7.3

Source : Susper surveys, 2002

The tools possessed by farmers are mostly the hoe, the sickle, the pumps and the sprayers (see Table 16).

Table 16-Farming equipment and tools

Description	Urban	Peri-urban
Pumping machine	45.6	61.3
Manual Thresher	0.30	0.00
Cultivator	0.70	0.40
Disc plow	1.30	0.00
Motivator	1.30	0.00
Hoe	97.3	80.2
Sickle	85.9	74.6
Weeding implements	57.0	57.3
Yolk	36.2	14.9
Sprayer	54.5	57.7

Source : Susper surveys, 2002

The Cambodian family traditionally raises 2-3 cattle, 1-2 pigs, and a few chickens/ducks. The survey shows that 25.4% of 247 peri-urban families and 32.9% of 150 urban families raise draft cattle (see Table 17). These low figures explain that some farmers meet difficulties in farming which affect cultivation calendar, when they have to hire draft animals from their neighbours.

It also shows that the percentage of families raising chicken is about 31 among 397 families interviewed. The reason that makes most of them not raising chickens/ducks is because chicken/ducks eat their vegetables.

There are around 10% of families raising pigs. Raising pig requires a lot of money to invest in piglets and feed. Family pig raising is more for savings than for profit.

Table 17-Livestock

Livestock	Percentage of farmers feeding animals	
	Urban area	Peri-urban area
Cow/buffalo (milk)	0.00	0.00
Pig	9.4	11.3
Draft animal		
Buffalo	0.7	1.2
Bull/ox and cow	32.9	25.4
Sheep/goats	0.00	0.00
Poultry	29.5	31

Source : Susper surveys, 2002

Surrounding the farmers' house, a small garden is sometimes found which is of 3m-6.6m² in size and covered by mixed vegetables. The percentage of families having a home garden is 10.7 in Urban districts and 19.8 in Peri-urban districts.

All these indicators reflect the living standard of those families, which is presently quite low.

F. Manure sources

The manure that farmers commonly use to feed their crops is from cattle dung, chicken/duck feces. There are 8% of urban farmers and 27.8% of peri-urban farmers using cattle dung (Table 18). There is a weak relation between the disposal of cattle and the use of cattle dung: for instance, in Dangkor district, 40% of farmers own bulls for draft, but only 2% use cattle dung. There may be a lack of knowledge on the use of manure. Some farmers believe that cattle dung attracts termites that eventually destroy roots/trunks of crops. The percentage of farmers using chicken/duck to feed their crops is about 6% only in urban areas while nearly no farmer use this kind of manure in peri-urban areas. Poultry manure is believed by farmers to have low yield efficiency relative to chemical fertilizer supply, which is used by all interviewed farmers.

Table 18-Type of manure used by farmers (% of farmers)

Manure type	Percentage farmers using type of manure	
	Urban area	Peri-urban area
Chicken feces	5.70	0.50
Cattle dung	8.00	27.8
Bat feces	1.40	0.00
Duck feces	6.50	0.00

Source : Susper surveys, 2002

There are about 18% of families who can produce their own manure and about 24% that have to buy manure from outsiders to feed their crops (see Table 19).

Table 19- Source of Manure (% of farmers)

Sources	Urban area	Peri-urban area
Owned	16.8	19.3
Bought	26.6	19.7
Sold	0.00	0.00
No use	56.6	61.00

Source : Susper surveys, 2002

G. Cropping Calendar

In Cambodia, cropping mostly takes place in the early wet season in June and in the early dry season in late November. The early wet season is the suitable season for cultivating crops because there is sufficient water and the flood does not come yet. Flood normally comes from October to November during which there is no cropping on flooded cultivated fields but certain crops are cultivated near the villages. The cropping starts again in the early dry season from late November or December and finishes by March. During this season, crops grow well and produce full yields because of nice weather and enriched soils. It is deduced that the suitable seasons for cropping in Urban and Peri-urban areas are in the wet season from May/June to August/September and in the dry season from November/December to end to March/April. The cropping calendar of the different crops is indicated in figure 2.

The crops grown by farmers are much diversified (more than 40 crops quoted by farmers, including 30 vegetables) – see Table 20. The major vegetables are: cucumber (20% of quotations), petsai (7%), Chinese kale, lettuce and cauliflower (6% for each). The low percentages of tomato and cabbage (3%) are quite surprising and would deserve some data checking.

Table 20-Crops grown by farmers

Vegetables	Number of growers	Percentage of growers	Percentage of quotations
Bitter gourd	24	6%	4%
Cabbage	10	2%	1%
Cauliflower	38	10%	6%
Chinese cabbage	32	8%	4%
Chinese kale	48	12%	6%
Cucumber	146	37%	20%
Eggplant	7	2%	1%
Lettuce	35	9%	6%
Black mustard	9	2%	1%
Green mustard	19	5%	3%
Petsai	27	7%	7%
Herbs	24	6%	4%
String bean	51	13%	5%
Tomato	18	5%	2%
Water convolvulus	6	1%	1%
Rice	148	37%	14%

Note: These crops can be grown several times a year, hence the percentage of quotations is different from the percentage of farmers. It is likely that the category petsaï includes pakchoi (or choysum).

Source: Susper surveys, 2002

Figure 2-Cropping Calendar in urban and peri-urban areas

No	Variety	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
		Week											
1	Rice			3rd		3rd						2nd	1st
2	Maize			2nd		4th			2nd				4th
3	Cucumber	4th	4th		1st		3rd		1st				2nd
4	Cauliflower	1st		1st			4th		4th				
5	BitterGourd		4th			3rd			1st			4th	
6	Cabbage		3rd		3rd	2nd		1st					
7	ChineseCabb		2nd				1st		2nd				4th
8	Eggplant	2nd		2nd		1st		2nd					
9	Stringbean		2nd				1st		1st				1st
10	Masta Black						2nd	3rd					
11	Masta Green	4th	3rd		1st		3rd	4th					2nd
12	Lettuce	4th	4th		1st		2nd	3rd					2nd
13	ChineseKale		3rd				3rd			1st			1st
14	Pea		2nd			1st		1st					1st

No	Variety	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
		Week											
15	Choysum	4th	2nd	4th				1st	2nd				2nd
16	KangKong	1st					1st	1st				4th	
17	Garlic	3rd					1st		1st			3rd	
18	Tomato		2nd 4th		3rd	1st	2nd						2nd

Source: Susper surveys, 2002. We have calculated the average time for the sowing and harvesting of each crop.

There are some differences according to the districts showing some degree of specialisation: tomato is more grown in Dangkor (9%), rice is more grown in Dangkor and Kien Svay (35% and 22% respectively), cucumber is more grown in Dangkor (35%), lettuce is more grown in Russey Keo (38%), while Chinese kale is more grown in Mean Chey (16%) and Saang (14%). The average rice area in Dangkor is 1,11 (st.d.=0,71), while the average in Russey Keo and Kien Svay is 0,35, and the average for Saang is 0,40. It is in Saang district, the furthest from the city, that crops are most diversified: 31 crops quoted, relative to 13 (Dangkor), 15 (Mean Chey), 17 (Russey Keo) and 20 (Kien Svay). The growing of papaya, ginger and sugarcane is only quoted in Saang district. It would be interesting to investigate the source of these specializations;

In the sample, 11 farms do not grow any vegetables (4 in Dangkor, 1 in RuseyKeo, 3 in Kien Svay and 3 in Saang). Nine of them grow rice, alone for 5 of them, and in rotation with other crops for 4 of them (maize, sugar, papaya or yam bean).

V SOURCES OF INPUTS

Farmers traditionally preserve some kinds of crops, which can be transplanted or produce seeds after harvesting, e.g. cucumber. Some kinds of crops cannot produce their seeds or be transplanted. So farmers need to buy such crops at the market when next cultivation comes. Sometimes they also need new varieties from the shops. While 53% of farmers in peri-urban areas produce their seeds, the percentage is 27% in urban districts, the rest originating from city sellers or village shops. This may be due to the proximity of points of sale in urban districts relative to peri-urban districts.

Pesticide and chemical fertilizer are available at the markets. They are mostly imported. Most farmers buy pesticides and fertilisers in markets, especially the urban farmers, while some farmers of the peri-urban areas buy these products from village sellers, in shops or individually. (see Table 21). Urban and peri-urban farmers tend to purchase their inputs from markets rather than village shops. The reason is that the varieties of inputs at the markets are more diverse and available than in the village shop and the price of inputs is cheaper.

Table 21- Sources of input purchased

Source	Seed		Fertilizer		Pesticide	
	Urban	Peri-urban	Urban	Peri-urban	Urban	Peri-urban
Home produced	26.8	53.4	0.00	0.00	0.00	0.00
Co-farmers	0.00	0.00	0.00	0.00	0.00	0.00
Village shop	26.2	25.4	17.4	25.9	15.4	23.3
Input/output dealer in village	2.70	0.00	4.70	8.50	3.40	9.50
Input/output dealer in town	44.3	21.2	77.9	65.6	81.2	67.2
Cooperative/Extension Agent	0.00	0.00	0.00	0.00	0.00	0.00

Source: Susper surveys, 2002

VI SOME DATA ON OUTPUTS

The data on yields and incomes as declared by farmers are indicated in Table 22 and Table 23. These data should be used with caution as it is always difficult to have reliable data on yields and incomes from one-shot surveys, especially for vegetables, and even more for the vegetables. The yields declared for tomato are especially low (3 tons/hectare), for instance when compares with the tomato yield in Kandal reported by Abedullah and al (2002), i.e., 8 t/ha, or the ones given by Agrisud experiments (11 t/ha with a Chinese variety, and 32 t/ha for Mongal variety – see Nouvellet, 2001). The in-depth tomato chain study carried out in Component 2 (Sokhen, forthcoming), will give more reliable results. The highest incomes (more than 6M Riels/hectare, i.e. 1500$/ha) are mostly for various types of brassicacae (cabbage, cauliflower, broccoli, petsai, mustard, Chinese kale), as well as bitter gourd.

Table 22-Yields per crops

Vegetable	Number of growers	Average yield (t/ha)	Standard deviation	Yield in Kandal province (1)
Bitter gourd	24	8.56	6.10	5
Cabbage	10	9.91	7.45	16
Chinese cabbage	32	6.65	3.97	12
Chinese kale	48	8.25	4.15	10
Cucumber	146	5.47	4.00	11
Eggplant	7	5.31	3.61	6
Lettuce	35	4.68	3.09	9
Black mustard	9	7.40	4.38	
Green mustard	19	6.60	2.95	
Tomato	18	3.03	2.09	8
Water convolvulus	6	15.51	22.31	

Source: Susper surveys, 2002 and Abedullah and al (1)

Table 23-Incomes per crops

Vegetable	Number of growers	Average income (M Riels/ha)	Standard deviation
Bitter gourd	24	7.86	7.91
Broccoli	1	6.62	1.23
Cabbage	10	6.50	5.00
Cauliflower	38	6.89	5.79
Chinese cabbage	32	4.52	2.84
Chinese kale	48	6.32	3.71
Cucumber	146	2.78	2.40
Eggplant	7	2.75	1.52
Lettuce	35	4.98	4.74
Black mustard	9	5.84	6.25
Green mustard	19	5.94	4.66
Pea	12	5.19	4.08
Petsai	27	5.28	2.98
Tomato	18	1.47	1.07
Water convolvulus	6	2.38	1.59
Mixed vegetables	4	6.49	4.62

Other crops (>4 M Riels/ha)	Number of growers	Average income (M Riels/ha)	Standard deviation
Banana	4	4.33	5.69
Ginger	2	5.43	2.65
Papaya	3	4.15	4.32
Sugar cane	7	4.07	1.68

Note- one farmer grows kimchay, earning 8.75 MRiels/ha, and one grows jujube, earning 6.67 MRiels/ha.

The incomes generated by the four main crops grown in succession are indicated in **Erreur ! Source du renvoi introuvable.** and **Erreur ! Source du renvoi introuvable.**.The highest incomes are declared in Mean Chey, Russey Keo and Saang districts, while the lowest incomes are obtained in Dangkor and Kien Svay, which can be related to the importance of rice cultivation relative to vegetable growing in these two districts. Russey Keo has also a low average income but with high dispersion.

Even if the total farm income, taking account of all the crops grown in the farm, may be twice higher, it still gives a low overall income (less than 1,000 $ per year on average).

Table 24-Average incomes by district obtained with the 4 main crops (Riels)

District	Number of farmers	Minimum	Maximum	Mean	Std. Deviation
Mean chey	39	100,000	7,330,000	2,829,756	1,750,610
Dang Kor	40	130,000	3,520,000	1,097,561	877,540
Russey Keo	42	105,000	8,350,000	1,746,281	20,388,856
Kien Svay	66	200,000	15,300,000	2,123,929	2,166,195
Saang	74	270,000	13,100,000	37,011,139	2,335,149
All	265	100,000	15,300,000	2,167,086	2,069,112

Source: Susper surveys, 2002

Table 25- Average incomes by district obtained with the 4 main crops (USD)

District	Number of farmers	Minimum	Maximum	Mean	Std. Deviation
Mean chey	39	25	1865	720	445
Dang Kor	40	33	896	279	223
Russey Keo	42	27	2125	444	5188
Kien Svay	66	51	3893	540	551
Saang	74	69	3333	942	594
All	265	25	3893	551	526

Source: Susper surveys, 2002
Taking 1$=3,930 Riels at the time of survey

60% of the interviewed farmers have off-farm income. In the analysis of production systems in Saang conducted by Agrisud in 2000 (Constant and al, 2000), it was reported that 64% of farms have off-farm income, from trade, fishing or sale of labour, especially in the rainy season.

The total income, including farm income (from the four main crops) and off-farm income, is indicated in **Erreur ! Source du renvoi introuvable.** and **Erreur ! Source du renvoi introuvable.**. The farm income represents 54 to 89% of the total income. The highest incomes are obtained in Saang and Mean Chey districts. We still get overall incomes lower than 1000 $/year, apart from Saang district. Yet these figures should be used with caution, given the difficulties to get reliable income data based on one-shot declarative surveys, and the high variability of incomes: the standard deviation is 526 for farm incomes in dollars, and 527 for off-farm incomes in dollars. Farm yearly incomes range from 25 to 3893 $, off-farm incomes from 0 to 4580$.

Table 26-Total household income (Riels/year)

District	Farm income (1)	Off-farm income	Total income	Farm income/total income
Mean chey	2829756	465882	3295638	86%
Dang Kor	1097500	931765	2029265	54%
Russey Keo	1746281	539667	2285948	76%
Kien Svay	2123929	711429	2835358	75%
Saang	3701139	2027127	5728266	65%
All (mean)	2167086	1213079	3380165	64%

(1): taking account of the four main crops only
Source: Susper surveys, 2002

Table 27- Total household income (dollars/year)

District	Farm income	Off-farm income	Total income
Mean chey	720	119	839
Dang Kor	279	237	516
Russey Keo	444	137	582
Kien Svay	540	181	721
Saang	942	516	1458
All (mean)	551	309	860
Urban areas	479	149	628
Peri-urban areas	806	386	1191

(1): taking account of the four main crops only
Source: Susper surveys, 2002

For the 7 non vegetable farms for which we have income data, the crop income amounts to 215$ per year only. Only two of them have off-farm income.

VII MARKETING PLACES

The most commonly stakeholder buying output is the output dealer in town (76% of answers), which refers to wholesalers based in the city (some of whom may be involved in assembling) – see Table 28. 15% of farmers quote assemblers, while few farmers refer to input dealers (8%), or

selling directly in village shops (4 answers, including 3 in Saang and 1 in DangKor). The percentage of farmers selling to urban traders is expectedly higher in urban areas than in peri-urban areas, while the quotations of assemblers are higher in the peri-urban districts, which reflects that the higher the distance from farm to market, the higher the number of market intermediaries. Details on marketing chains are provided in Sokhen and al (2004) and Sokhen, forthcoming.

Table 28-Purchaser of farmers' output (% of farmers)

	Total number	% (total)	% (urban districts)	% (peri-urban districts)
Output dealer in town	258	76%	87%	68%
Output dealer/assembler	49	15%	5%	22%
Input dealer in village	11	3%	4%	3%
Input village in town	16	5%	3%	6%
Village shop	4	1%	1%	2%
Total	**338**	**100%**		

Source: Susper surveys, 2002 - note: 59 missing answers

As regards the distance traveled to sell output, 20% of farmers sell on the spot, while 35% move up to 5 km, 20% between 5 and 10 km, 20% from 10 to 30 km and 5% more than 30 km (Table 29). The average distance traveled is 10 kilometres, with an average standard deviation of 17. The distance to selling place is the highest in Saang, the most distant district (21 km on average) – see Table 30.

Table 29-Distance traveled to sell output

Distance	Nr of farmers	% of farmers
0km	68	20%
0 to 5 km	120	35%
5 to 10 km	67	20%
10 to 30 km	68	20%
More than 30 km	17	5%
Total of farmers	**340**	

Source: Susper surveys, 2002

Table 30-Distance travelled to sell output according to district

District	Average distance to selling place	Standard deviation
Dang Kor	7.70	4.60
Kien Svay	3.51	5.89
Mean chey	3.70	0.86
Russey Keo	8.31	15.86
Saang	20.95	24.64

Source: Susper surveys, 2002

VIII CONSTRAINTS TO VEGETABLE PRODUCTION

The quoted obstacles which farmers face from year to year in both urban and peri-urban areas include flooding, low output price, marketing problems, high input cost, lack of labour, water shortage, difficult access to pesticides and fertilizers, and land shortage (see Table 32). Flooding is a major concern, which affects cultivation calendar and farmers' income. In Cambodia, flood occurs nearly every year and always destroys hectares of vegetables/crops worth thousands of dollars. There are 71.8% of urban families and 84.1% of peri-urban families complaining about floods. Yet there should be more analysis of the relation between the water regime and the cropping systems as the floods may actually help in the soil fertility in the dry season.

High input costs and low output price are also obstacles that cause farmer's income to decrease. Sometimes this makes farmers unable to make any profits from farming but just waste time and labor or even lose capitals. 90.6% of urban farmers and 94.4% of peri-urban farmers face market problems – although we should get more information on the type of vegetables and the time of the year when this mostly happens.

Water shortage is another major problem, which affects the cultivation. In Cambodia the water shortage happens throughout the country not only in urban and peri-urban areas. However there are not many irrigation systems created to meet this demand. To improve the status of water shortage, the irrigation systems should be developed at each village in order to bring and reserve water for vegetables especially in dry season, after a prior consultation of farmers on the subject.

Land shortage is another obstacle contributing to production limitation. There are 67.8% of urban and 73.8% of peri-urban families who always meet land shortage for growing their crops. When taking out Dangkor, where 60% of farms complain about land shortage, the percentages are similar for urban areas (72%) and peri-urban areas (73%).

Table 31- Constraints to vegetable production declared by farmers

Constraints	Urban	Peri-urban
Flooding	71.8	84.1
Low output prices	56.4	85.6
Marketing problem	90.6	94.4
High input cost	92.6	89.2
Labor shortage	39.6	38.5
Water shortage	65.1	55.4
Non-availability of fertilizer	6.0	5.7
Non-availability of pesticide	14.1	21.5
Land shortage	67.8	73.8
Others	47.0	42.6

Source: Susper surveys, 2002

Some differences according to districts are indicated below (see Table 32):

- the shortage of labour is more frequently quoted in Dangkor than in the other districts (56% relative to 38% on average), maybe because of the presence of factories in this district;

- the shortage of water is more frequently quoted in Dangkor (78%) and Mean Chey (68%), relative to the average of 61%, while the lowest frequency is for Russey Keo (49%)
- in Dangkor, floods are much less quoted than in the other districts (40%, relative to an average of 77%).
- We had mentioned before the sandy nature of soils in Dangkor which may explain the higher frequency of water shortages and lower frequency of floods.

Table 32-Constraints declared by farmers according to districts

District	Shortage of labor	Shortage of water	Flood During Wet Season
Dang Kor	56%	78%	40%
Kien Svay	26%	52%	83%
Mean chey	48%	68%	88%
Russey Keo	14%	49%	88%
Saang	48%	59%	86%
Average	**38%**	**61%**	**77%**

Source: Susper surveys, 2002

As regards the 11 farms not involved in vegetable growing, they all declare shortage of land as their main constraint.

IX CONCLUSIONS AND RECOMMENDATIONS

From the data on basic assets which each family possesses and income data, it is deduced that farmers in both Urban and Peri-urban areas are living in poor conditions with a low income generated from crops cultivation, and limited off-farm income, that makes it difficult to feed their 4 members Each family owns a small size of land that affects its ability of vegetable production. Obstacles such as flood, water shortage, agricultural market problems, input and output cost, cultivated land shortage, etc. explain their low agricultural production success. Yet, these farmers have experienced at least over 10 years in vegetable cultivation.

The survey shows some differences in the farm characteristics according to the districts. Dangkor is a specific district as it has more rice growing, more sandy land, less floods but more water shortages. Saang has more diversified crops than the other districts. Kien Svay is a district with average characteristics relative to the other ones, in particular in terms of water shortages and floods. Kandal (Saang and Kien Svay) districts are more suitable for vegetable production than Urban districts (Phnom Penh) because of water sources (river/lake) and less constraints on land (when not considering Dangkor in the comparison of land constraints).

To develop the agricultural production in these both areas, irrigation systems should be improved first to ensure water for cultivation, and then proper agricultural technologies should be launched at the village level to enable less seasonal cultivation.

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APPENDIX

QUESTIONNAIRE

- The questionnaire was designed by Dr Mubarik Ali and was slightly corrected after field tests -

INTERVIEW SCHEDULE FOR BASIC INFORMATION SURVEY IN PHNOM PENH

Investigators Name:_____ Date of interview _____

SECTION 1. GENERAL INFORMATION AND FARMER'S ASSETS

I. Farmer's Identification:

Name: _____

Address: Province: _____ District _____

Commune _____Village_____

II. Land ownership (ha)

i) No of fragmented parcels _____

ii) Land owned:_____ ii) Rented in/share cropped in _____

iii) Rented out/share cropped out:_____ iv) Encroached _____

iv) Any plan to increase or decrease the size: YES _____ NO _____

If Yes, how and how much _____ [increase (+) or decrease (-)] ha

vii) Land rent: (CR/ha/year) _____

III. Irrigation status

i) Irrigated area (ha) _____ ii) Unirrigated area (ha) _____

iii) Source of irrigation (Tick the appropriate source)

Canal ____ Tubewell ____ Well ____ Water reservoir ____ Others ____

iv) Do you face water shortage for vegetables? Yes __ NO__ If Yes, what months _____

v) Are your fields under flood? YES ___ NO ___ If YES, what months _____

IV. Operator's characteristics: Sex ___(m/f); Age (year)_____ Education _____ year

Farming experience (year) _____ Vegetable experience (year) _____

V. Migration status of the family: Are you migrant: YES _____ NO _____ If **YES**

i) When did you migrate to Phnom Penh _____ Year

ii) From where did you migrate _____ Province

iii) Occupation before coming Phnom Penh _____

iv) Reasons of migration to Phnom Penh _____

_____

v) Are you planning to move another place:Yes ___ No___ If Yes,when _____Year

Why _____

vi). Purchase of food: Do you purchase major foods from market YES___ NO____ If YES
How much (%): Rice _____ Others _____

SECTION 2. FAMILY COMPOSITION

Particular	Years of education	Occupation	%time on the farm	Remittance (CR/month)
Male adult (over 14 years)				
1.				
2.				
3.				
4.				
5.				
Female adult (over 14 years)				
1.				
2.				
3.				
4.				
5.				
Children (Male)				
1.				
2.				
3.				
4.				
5.				
Children (female)				
1.				
2.				
3.				
4.				
5.				

1 = Farming; 2 = Hired labor on others farm; 3 = Manual work in others house; 4 = Trader;
5 = Government job; 6= House keeping; 7= Student; 8 = Other (specify).

SECTION 3. ASSET OWNERSHIP

i) Status of house ownership: owned____ Rented in____ Free___
ii) Do you have home garden: Yes _____ No _____ If **Yes,** how big _____m^2
iii) Ownership of other household belongings (Number)
Fan_____ Refrigerator_____ Cassette Player/radio_____ Washing machine _____
Bicycle_____ Pickup truck_____ Television_____ Motorcycle _____
Air conditioner _____ Telephone _____ Others_____

iii) Ownership of Agricultural Machinery (No.)

Tractor _____ Trolley _____ Tubewell _____ Thrasher: Manual_____
Thresher power driven_____ Cultivator _____ Disc plow _____ Rotavator _____
Pesticide sprayer: manual_____ Sprayer power driven_____ ____Yolk _____
Sickle _____ Spade _____Weeding implements _____

iv) Ownership of livestock (No.)

Milking/meat animals: Buffalo_____ Cow_____ Pig _____
Draft animals: Buffalo _____ Bullock/Cow_____
Young stock _____ Goat/Sheep _____ Poultry/duck birds_____
Annual income from milk and meat (CR) _____
Amount of total manure available (t/month) _____

v) Manure bought (t/year) _____ Sold (t/year) _____

Types of manure purchased/sold _____ Price (CR/t) _____
Crops manure application (t/year) Vegetables _____ Fruit tress _____Other _____

vi) Ownership of fish pond: Yes_____ No _____

If Yes, size of the fish farm _____m^2
Monthly output (kg): Fish _____ Shrimp _____ Others _____
Monthly income (CR) _____

SECTION 4. SOIL TYPE AND LAND TYPES

PARCEL NO.	Soil texture	Color (when dry)	Drainage	Landform	Erosion	Distance from water source (m)
1.						
2.						
3.						

Soil texture : 1 = Heavy 2 = medium 3 = light
Color : 1 = Red2 = yellow 3 = brown 4 = black
Drainage : 1 = Good 2 = Medium 3 = Poor
Landform : 1 = slope with terrace 2 = slope without terraces 3 = plain
4 = mountain foot slope 5 = river bank
Erosion : 1 = none 2 = few 3 = a lot

SECTION5: CROPPING PATTERN, CROP SCHEDULE, AND INCOME

	Crop Area (ha)	Schedule (week/month) Sowing	Harvesting(Kg)	Fertilizer (Spray)	Pesticide (L. day)	H. labor (kg)	Yield (CR/month)	Income
Rice	_____	_____	_____	_____	_____	_____	_____	_____

Maize _____ _____ _____ _____ _____ _____ _____ _____

Vegetables

i)_____ _____ _____ _____ _____ _____ _____ _____

ii)_____ _____ _____ _____ _____ _____ _____ _____

iii)_____ _____ _____ _____ _____ _____ _____ _____

iv)_____ _____ _____ _____ _____ _____ _____ _____

Fruits

i)_____ _____ _____ _____ _____ _____

ii)_____ _____ _____ _____ _____ _____

iii)_____ _____ _____ _____ _____ _____

iv)_____ _____ _____ _____ _____ _____

Other crops_____ _____ _____ _____ _____ _____ _____ _____

(specify)

Flooding _____ _____ _____

Fallow _____ _____ _____

SECTION 6. INPUT SOURCE

i) **Credit**

Credit source	Amount/ (CR/year)	Purpose of loan	Type of loan	Interest rate/month
Village money lender				
Parents, friends, relatives				
Input/output traders				
Cooperatives				
Banks				
Others				

Purpose of loan: 1 = fertilizer 2.=Pesticide 3.=Seed 4= Personal 5 = Agriculture and Personal
Type 1= Cash 2= kind

ii) Information

Source	Variety/seed	Technology	Fertilizer	Plant protection	Prices
Friends & Relatives					
Government agents/technicians					
Input/output dealers					
Research station					
TV/Radio/Newspaper/magazine					

Cooperative					
Others					

I

ii) **Sources of input purchase and output selling**

Source	Source of purchase/selling				Distance traveled			
	Seed	Fertilizer	Pesticide	Output	Seed	Fertilizer	Pesticide	Output
Home produced/consumed					-	-	-	-
Village shop					-	-	-	-
Input dealer in village					-	-	-	-
Output dealer/assembler					-	-	-	-
Co-farmers					-	-	-	-
Input dealer in town								
Output dealer in town								
Cooperatives					-	-	-	-
Extension agent								
Payment (1 = cash, 2 = loan)					-	-	-	-

SECTION 7. PRODUCTION CONSTRAINTS

I. Insect/Pest problem:

Despite using pesticide, is insect/pest a serious problem in vegetable production?:

YES _____ NO _____

If yes, what are the losses in vegetable yield due to insect/pest last year

Wet season Vegetable	Yield loss (%)	Dry season vegetables	Yield loss (%)
1. _____	_____	1. _____	_____
2. _____		2. _____	_____
3. _____		3. _____	_____
4. _____		4. _____	_____

II. Natural Control of insects:

Do you use natural control of pest: YES _____ NO _____

If YES, what control you use?

Biological 2. Structure 3. Crop rotation 4. Sex hormone

Trap cop 6. Kill by hand 7. Light trap 8. Others

What are the advantages of Natural Control?

_____

What are disadvantages of Natural Control

_____

III. Major constraints in the expansion of vegetable production:

i) Do you want to increase the proportion of vegetable area: YES _____ NO _____

ii) What are the major constraints (other than pests)

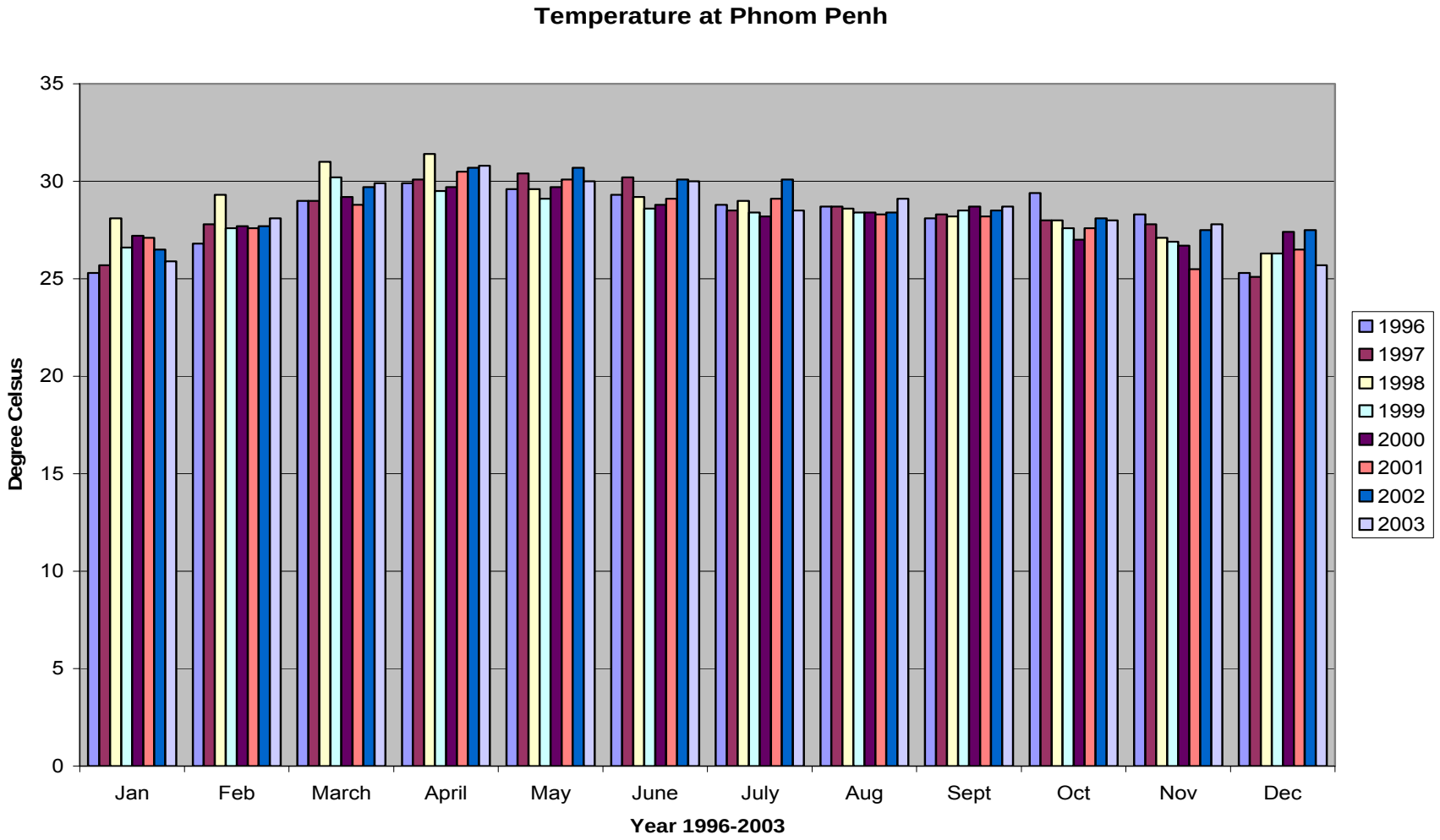
1. Shortage of labor
2. Shortage of water
3. Flooding during wet season
4. Non-availability of fertilizer
5. Non-availability of pesticide
6. Low output price
7. Marketing problems
8. High input cost
9. Land shortage
10. Others

Table 33- Phnom Penh Average Temperature, Rainfall, and Humidity

- Temperature in degree Celsius, Rainfall in mm, humidity in percentage-

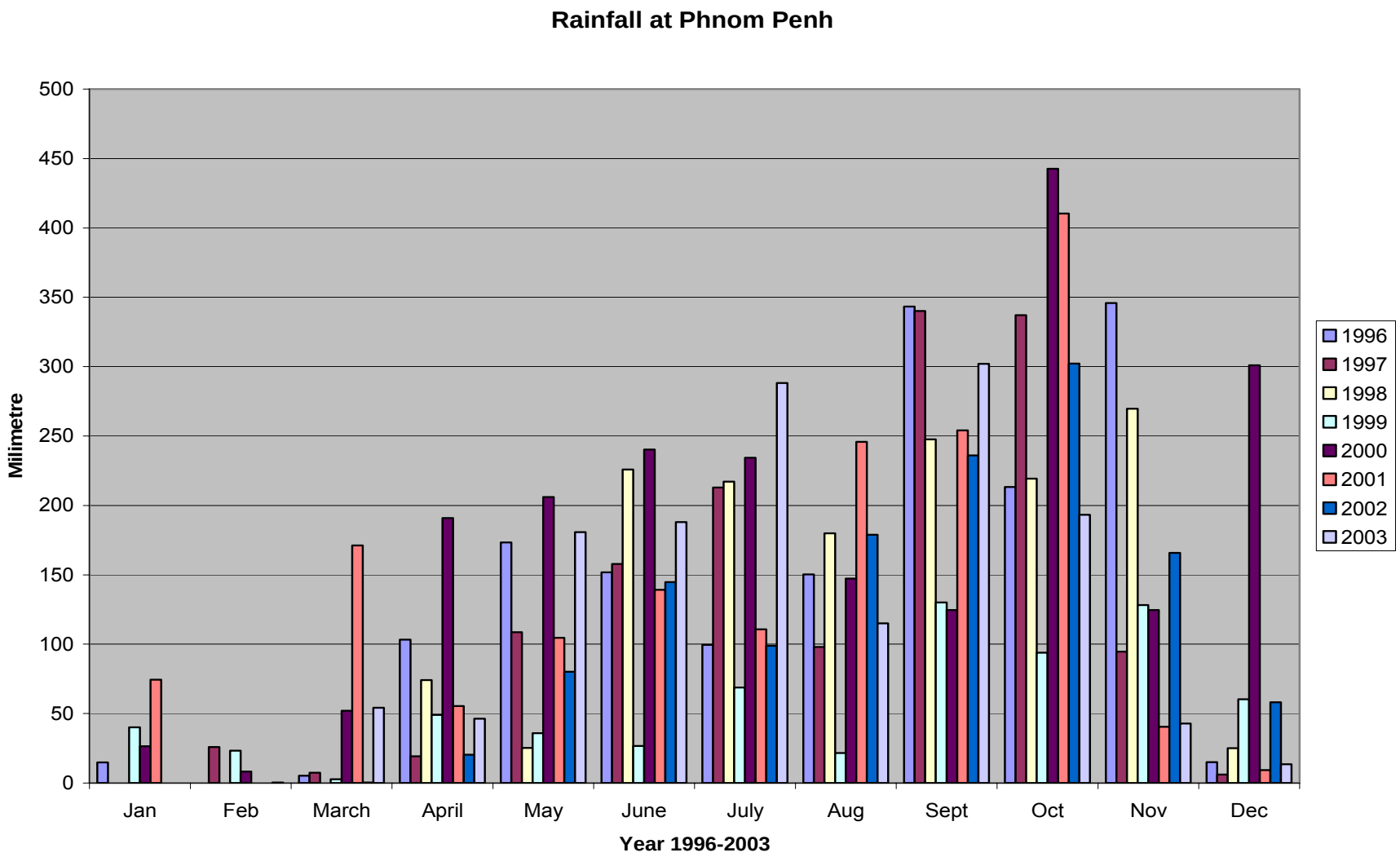
Year	Description	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1996	Temperature	25.3	26.8	29.0	29.9	29.6	29.3	28.8	28.7	28.1	29.4	28.3	25.3
	Rainfall	14.9	N/A	5.2	103.6	173.4	151.8	99.6	150.3	343.3	213.3	345.8	15.0
	Humidity	72	67	66	75	79	79	90	90	90	89	82	72
1997	Temperature	25.7	27.8	29.0	30.1	30.4	30.2	28.5	28.7	28.3	28.0	27.8	25.1
	Rainfall	N/A	26	7.4	19.2	108.6	157.9	212.9	98.1	340.1	337.1	94.6	6.0
	Humidity	73	74	73	73	84	73	80	81	84	84	80	73
1998	Temperature	28.1	29.3	31.0	31.4	29.6	29.2	29.0	28.6	28.2	28.0	27.1	26.3
	Rainfall	N/A	N/A	N/A	74.2	25.2	225.9	217.2	180	247.6	219.4	269.7	25.1
	Humidity	75	74	69	71	72	77	80	83	82	79	73	69
1999	Temperature	26.6	27.6	30.2	29.5	29.1	28.6	28.4	28.4	28.5	27.6	26.9	26.3
	Rainfall	40.1	23.3	2.7	49.0	35.8	26.7	68.7	21.5	130	93.8	128.2	60.3
	Humidity	79	75	76	82	81	80	81	81	84	87	84	77
2000	Temperature	27.2	27.7	29.2	29.7	29.7	28.8	28.2	28.4	28.7	27.0	26.7	27.4
	Rainfall	26.5	8.3	52.0	190.8	206	240.3	234.4	147.3	124.7	442.5	124.7	301.1
	Humidity	79	74	77	82	84	83	82	84	88	82	78	78
2001	Temperature	27.1	27.6	28.8	30.5	30.1	29.1	29.1	28.3	28.2	27.6	25.5	26.5
	Rainfall	74.4	0.0	171.1	55.5	104.7	139.2	110.6	245.8	254	410.3	40.5	9.2
	Humidity	73	75	80	76	80	80	80	82	85	86	76	73
2002	Temperature	26.5	27.7	29.7	30.7	30.7	30.1	30.1	28.4	28.5	28.1	27.5	27.5
	Rainfall	N/A	N/A	0.4	20.3	80.2	144.7	98.9	178.9	236.1	302.3	165.8	58.2
	Humidity	73	73	70	72	75	76	73	82	82	83	81	82
2003	Temperature	25.9	28.1	29.9	30.8	30.0	30.0	28.5	29.1	28.7	28.0	27.8	25.7
	Rainfall	N/A	0.4	54.3	46.4	180.8	188	288.3	115.1	302	193.3	42.8	13.4
	Humidity	74	71	69	71	78	77	83	80	83	84	76	72

Figure 3- Temperature in Phnom Penh



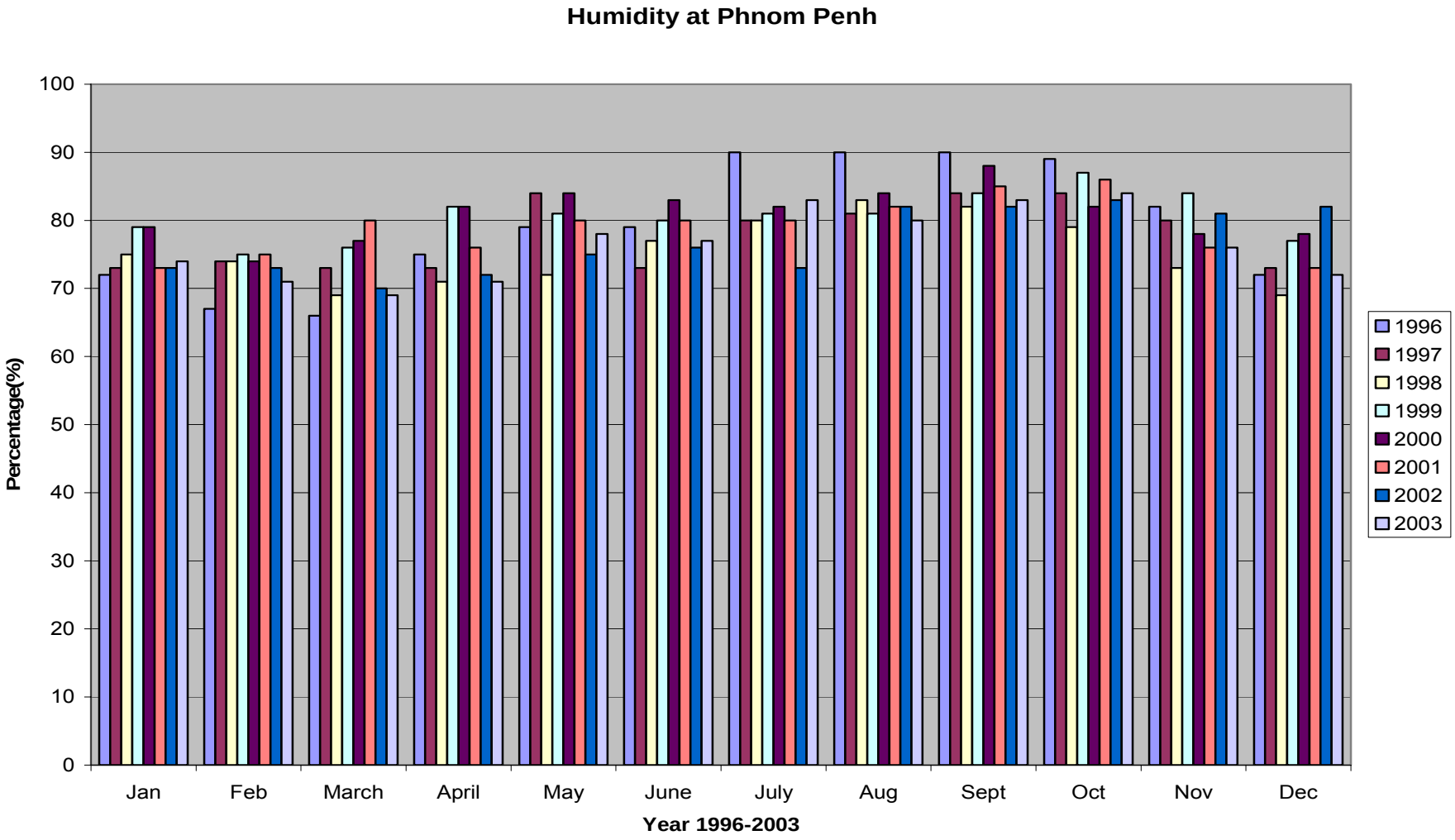
Source: Pochentong Weather Station

Figure 4- Rainfall in Phnom Penh



Source: Pochentong Weather Station

Figure 5- Humidity in Phnom Penh



Source: Pochentong Weather Station