

CHAPTER – I

A. WHAT IS URBAN AGRICULTURE – PERI URBAN AGRICULTURE

Urban and peri urban agriculture (UPA) is an activity that produces, processes and markets food and other products on land, and water in urban and peri urban areas, applying intensive production methods and (re)using natural resources and urban wastes. Food products include but are not limited to fruits, and vegetables, livestock, poultry and fish. Other UA products which generate income include amongst others, trees, shrubs, flowers and ornamental plants.

Studies conducted by the International development Research Centre (IDRC) Canada revealed that 56% of the worlds absolute poor will be living in urban areas within the next two years. Poor men and women who practice UA do so to increase household food security and to generate income. Urban agriculture also plays an important role in environmental and public health by treating, reusing and managing both sewage and solid urban waste.

Urban and peri urban agriculture (UPA) has been practiced in Nepal since time immemorial UPA has complemented rural food production. It has also strengthened the national food supply system. The share of UPA contribution to national food production in Nepal is quite high and it is expected to increase further in the years to come. Contribution to world food production by UA, which was 15% in 1993 is expected to increase to 33% in 2005 (CFP Report Series Report 22). There is a similar trend in Nepal too. There has been no definite study to find out the actual contribution of UPA to Nepal's food supply.

Urban agriculture of some sort is found in almost 80% of the urban households in Nepal. The practitioners are mostly women. Produce from UA provides food security to the majority, others have been earning some cash by selling surplus.

Vast areas of land which were once farmed between urban towns have given way to small well organized kitchen gardens growing many types of crops. After new settlements are established. These family gardens range from 20 square metres to over 500 sq. meters. Products from such gardens contribute significantly to the food supply of

the family. It also reduces the cost on food (usually over 70% of total household expenses) of the urban poor.

Although UPA is such an important topic which contributes to the national food supply system, it has not received enough attention by government leaders. It is hoped that there will be a change in their attitude towards UPA after reading this manual.

B. URBAN PERI URBAN AGRICULTURE A SUBJECT OF PRIORITY

Agriculture is associated with rural areas because under usual circumstances it is practiced in these areas. To many people who live in crowded cities and who are not involved in food production but buy their food from the local market it is thinkable that farming is possible in crowded urban areas. Urban areas are heavily populated and have scarcity of land for farming purposes, this is the general opinion. To many policy makers and agricultural researchers urban agriculture is not the priority and is not high in their agenda for attention. It also is pushed back where action and funding is necessary. This attitude is prevalent not only amongst officials in Nepal but is common in most major cities in Asia.

Urban agriculture is the primary activity of the urban poor or is practiced by individual households to meet only their daily need of food this is the general view therefore there is a lack of interest amongst the concerned researchers and officials. Urban agriculture needs land which is scarce in crowded cities. Government officers, planners and supporters of agriculture prefer to direct their attention to rural areas where land is not the limiting factor for agriculture development. In the case of urban agriculture, the authorities would prefer that the urban poor use vacant areas to grow their food; bureaucrats and city planners look the other way and pretend ignorance to what is taking place. However when it comes to legalizing the activity there is universal objection because the officials have a preconceived view of what a city should look like. Growing food in the heart of the city does not figure in their concept of a beautiful city.

Urban and peri urban agriculture must be given the highest priority by the concerned authorities in Nepal because recent studies elsewhere have shown that urban agriculture makes a significant contribution to many cities' food self reliance. Similar situations prevail in Nepal too. Although we are not sure of actual figures in Nepal,

significant urban dwellers are urban farmers providing food and income to almost four to six times their actual number. Many low income earners in urban Nepal have small farms where they grow food or raise animals to supplement their income. Twenty three percent of the vegetable consumed in Kathmandu is produced by poor farmers in UPAs. Food produced in UPAs is transported to the urban markets easily and cheaply. Saving the government large sum of money which can be diverted for other development works.

In most urban areas agriculture is practiced in areas which are not suitable for building construction, undeveloped land, idle public or private land or in household spaces. The condition in Nepal is slightly different because there were less crowded cities and large pieces of land were available for cultivation even upto two decades ago. Situation has changed rapidly recently with most of the agricultural land being converted into residential areas. Still fairly large areas devoted to agriculture exists in most major cities although the actual area has not been measured. It can be said that such areas are large.

There is an urgent need to conduct a detailed study on the contribution of UPA in Nepal's economy. Such studies have been conducted in many countries and the results from these studies clearly show that UPA is extremely important in a country's development. It also shows that urban agriculture is clearly far more than a means of subsistence, an informal activity or an illegal business.

A survey conducted by UNDP identified seven urban farmer categories ranging from low income survival to middle income home gardeners to agri-business.

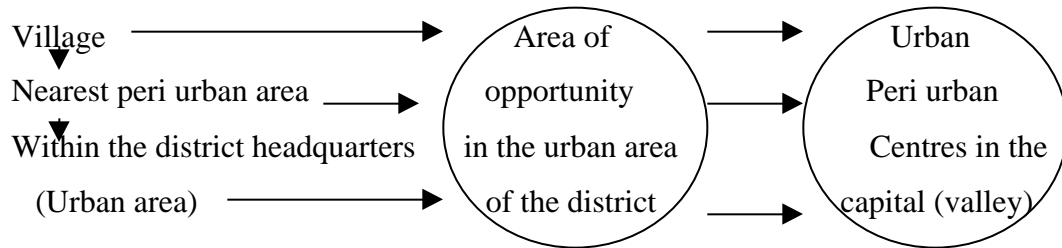
We have similar categories of urban farmers in Nepal too. Their contribution to the national economy and well being is enormous therefore the authorities must awaken to this fact and provide maximum priority for their development.

We have divided urban agriculture practitioners and supporters into twenty six groups. There are hundreds of families under each category who are contributing to UPA. The accumulated activities of these groups ensures the well being of thousands of other families living in urban and peri urban areas. It is the responsibility of everyone to support UPA because if present trend continues all the major urban and peri urban areas in Nepal will be heavily inhabited by the year 2010. The present trend of migration can be presented as :

a. Mode of migration (Residence purpose)

Village → Nearest peri urban area → District headquarter → Peri urban area in the Kathmandu valley → urban areas in the valley

b. Mode of migration (Employment and Livelihood)



If this trend continues, there will be less people living in villages and farms; the towns and cities and their peri-urban areas will be heavily populated. This makes it even more urgent to have an efficient UPA programme to enable the authorities to feed this mass of people living or who will live in the cities.

The large scale migration from rural areas into urban and peri urban areas is threatening the ecological balance. Large tracts of fertile land along the many river systems in the valley have been lost to carpet industries and housing. This trend is present in other parts of the country where liquor factories, paper mills and chemical industries are built along fertile river deltas and banks. Industries are replacing agriculture from urban, peri urban areas at the same time these factories are also a major source of pollution which affects UPA. The building industry is associated with the damage of large tracts of vegetable areas due to sand mining in these areas in Kathmandu Valley. Sand mining also damages river banks increasing the risk of flood in many urban areas. The amount of land available for urban agriculture will continue to shrink but the need for food in the cities will become more pressing. The authorities must make accurate and intelligent decisions about urban resource management while making plans for urban development and urban and peri urban agriculture must figure prominently in this master plan.

C. THE ROLE OF THE AUTHORITIES IN THE DEVELOPMENT OF UPA IN NEPAL

UPA in Nepal is not a new happening, it is a traditional way of life. Cows, Chicken, rice corn and vegetable are common in the urban environment. To many families growing their own food ensures their survival. Randomly conducted rapid appraisal showed 73% of the urban households were growing some type of food. The area of cultivation was less than 35 sq.m. in some cases. Most small areas cultivated (86%) were used to grow seasonal vegetables in winter and one major cereal in the monsoon. UPA is thus very important for the survival and well being of most of the urban poor. Despite this, still the government policies and regulations are not supportive of UPA. One good thing is that there is no strict opposition to the practice either. UPA as mentioned so many times in this report will play an important role in the well being of the people in Nepal in the years to come. Rough estimates show that more than half of Nepal's population will be living in urban and peri urban areas by the year 2020. The rate of migration from villages to the urban areas has increased significantly in recent years after the beginning of the armed struggle of the Maoist groups because the impact of the struggle is least in urban areas. The authorities in the urban areas must begin serious planning to settle these new arrivals and also to ensure adequate supply of food for them. To do this, they have to increase food production in urban areas and at the same time improve the transportation system from the peri urban and outside areas so that the food produced at these locations are available easily to the urbanites.

Some Important Policies which can assist UPA and which need prompt government attention are:

- a. Recognize the importance of UPA and give due attention to it while formulating urban and peri urban development plans :

It is high time policy makers and planners accept and promote food production in UPA as a critical factor for the well being of the people living in these areas. The food produced in UPA increases the self reliance on food in many urban areas of

- Nepal. We have already mentioned that about 23% of the supply of vegetables in Kathmandu is produced in its urban and peri urban areas. This could easily be raised to 76% if minor adjustments are made in the farming systems and roads from the peri urban to urban areas are improved.
- b. Nepal from being a food exporting country a few decades back has become a food importing nation. Food imports have weakened the production base in many UPA areas. Although the food produced in UPA areas contribute significantly to the overall food production, the development policies in agriculture deliberately starve the cities' agriculture of the needed cash and technologies. This bias against UPA must change.
 - . It is time government authorities pay more attention to UPA and remove their bias towards rural agriculture. The responsibility and the area covered by the agriculture extension workers should include UPA areas and the thousands of urban farmers who produce a significant amount of food in the country.
 - c. Urban farmers practice a wide range of farming systems; this is due to the ability of the urban farmer to adopt to different economic, social, cultural and environmental situations prevalent in urban areas. The farming systems are also a result of the diverse and varied needs of the urban consumers. Urban farmers in Thimi a sub metropolitan city, produce twenty-three different types of vegetables in a season in their one ropani of land. The government must support this type of production which is ideally modeled to meet urban needs.
 - d. Researchers who have been studying UPA have concluded that urban farming is not the business of recent immigrants from rural areas because urban farming needs resources and the new immigrants are resource starved. This situation is true under Nepal's context too. The authorities must therefore assist traditional urban farmers so that they are able to feed the new comers too. At the same time the newcomers must be geared to food production by supporting them with finances and skills. Careful planning is necessary before displacing the traditional food producers from their production areas in the name of development.
 - e. Planners have an important role to play in the advancement of urban and peri urban agriculture. Their critical contribution will be to create a precondition

where UPA can develop and expand. Creating conditions alone will not be enough. They must also ensure that the different partners who participate in UPA perform their part according to the agreed operational and development plans.

- f. UPA will exist in all developing countries in one form or other. If the authorities refuse to accept this fact and try to suppress its development, the people in urban areas will adopt other measures to circumvent the urban planning and implementation process if they feel a strong need for UPA in their area.

D. The Zoning Concept

Many countries have adopted zoning policies while urban development programmes are formulated. Zoning signifies the allocation of land in urban areas for specific purposes. Areas are identified within urban and peri urban areas which are best suited for agriculture but are not appropriate for and economical to be developed for other purposes, and such areas are allowed to be developed as urban, peri urban agricultural areas. Dr. Yue-man Yeung, a specialist in urban agriculture at the Chinese University in Hongkong sites the example of Shanghai city in China which was able to feed its three million people with food produced in the urban and peri-urban area of the city in the early 1930s. The Chinese government has built on this concept of self-sufficiency to keep pace with a growing urban population. The Nepalese government and institutions responsible with urban and peri urban planning must separate areas and develop them into zones for residential, commercial, industrial and agricultural purposes. This will enable the people in peri urban areas to earn a decent income by working in the agriculture sector rather than migrating into the core urban areas for jobs.

The extensive urban suburbs are key to urban farming in China. The government has extended the municipal boundaries to encompass agricultural land. The production from the suburbs is the key to feed the millions in Chinese cities. This basic fact of cities feeding people is ignored in Nepal; and building construction is allowed in prime agriculture areas with no concern to future food production, health and nutrition of the urban people. We strongly appeal to the concerned authorities to study and implement the ZONING concept for the development of urban and peri urban areas. Agriculture zones within urban areas are intensively cultivated to produce maximum products; we have

already mentioned about the large number of vegetables produced in small units of urban plots in Bhaktapur, Thimi. Such intensive cultivation requires that soil fertility be kept highly fertile. It is done through waste recycling which was a traditional practice of the Jyapus of the valley in urban areas. This practice has been abandoned after chemical fertilizer became readily available to them. In urban agriculture, zones not only assist in the production of essential food but also help in urban waste management that is important for a healthy urban environment.

Unplanned development, specially setting up industries inside urban areas and the establishment of colonies with concentrated housing built by immigrants from rural areas, has resulted in the loss of fertile land in all the three cities in the valley. A similar trend can be observed in urban towns in the districts too. This loss of prime agricultural land for residential or industrial purpose is something which every urban planner must be very careful about because once land is converted for residential or industrial use it cannot be converted back to agriculture warns Dr. Yeung from the Chinese University of Hong Kong.

The zoning concept for urban development is now an accepted development strategy. It is used in India (Banglore and other emerging cities), Shanghai (China) Hongkong (China), Singapore; Bangkok (Thailand) and many countries of the world where urban expansion is taking place rapidly. The use of land use zoning technique by accepting agriculture as the main or tertiary land use activity is employed in the major development plans in many cities.

E. Research and Development Needs and the Role of the Government Research Stations

The government organizations are the primary research institutes in Nepal. Research and development work is done primarily by ministries, departments, and universities in the country. Non governmental organizations assist by transferring the knowledge from research stations to the users. Extremely little research is done on urban and peri urban agriculture in Nepal. A few research studies mention UPA as a part of certain social or environmental project, but none of these treat UPA as a separate viable and vibrant urban activity so important for a prosperous city.

Urban agriculture is very different from general agriculture as it requires more specific technological and organizational skills. Urban agriculture is more intensive, it has to be more compatible with the urban environment and its stress and it has to be able to meet the needs of the urban population and market. It must also allow careful monitoring and evaluation because the activity (since it is conducted amongst the people themselves) can have a profound impact on the health and well being of the people.

The technologies must be readjusted to be appropriate and adaptable to small areas and small scale operations. Urban agriculture is practiced in small parcels of land by poorer sections of the people so the production technologies must suit this sector.

Keeping the unique characteristics of urban agriculture in mind, research organizations must design and prioritize research strategy to improve production in UPA. Training needs and extension methodologies for the UPA need to be evaluated and readjusted accordingly. Agricultural courses must include training on urban agriculture from an early stage.

Urban agriculture is a multi faceted activity. It has a unique land use system and is also an urban industry because it offers jobs. Urban agriculture must be treated as a package of opportunities. The research and development needs of UPA must include its social, economic, nutritional, cultural and managerial aspects. The research stations must allocate separate funds and depute experts to research and develop UPA because UPA's research and development needs are completely different from those of rural agriculture.

Research in urban agriculture must focus on its effect on health and well being of the people too. Urban agriculture is more intense therefore it needs much more inputs. Our survey has shown that good supply of water is a major constraint at present. We have also discovered that a lot of urban farms are using polluted water to irrigate their plots and to wash the vegetables and fruits before selling them. People do it without being aware of the dangers, but this practice is risky both to the producers and the consumers. The use of large dozes of insecticides and fungicides frequently also pollutes the atmosphere. Research also must be conducted to evaluate the environmental impact of UPA too. The authorities have to become aware that UPA is not only confined to food production in urban and peri urban areas but it affects the whole urban ecology. Research

on UPA must be carried out on its totality so that the beneficial as well as harmful impact can be measured and appropriate remedial steps taken.

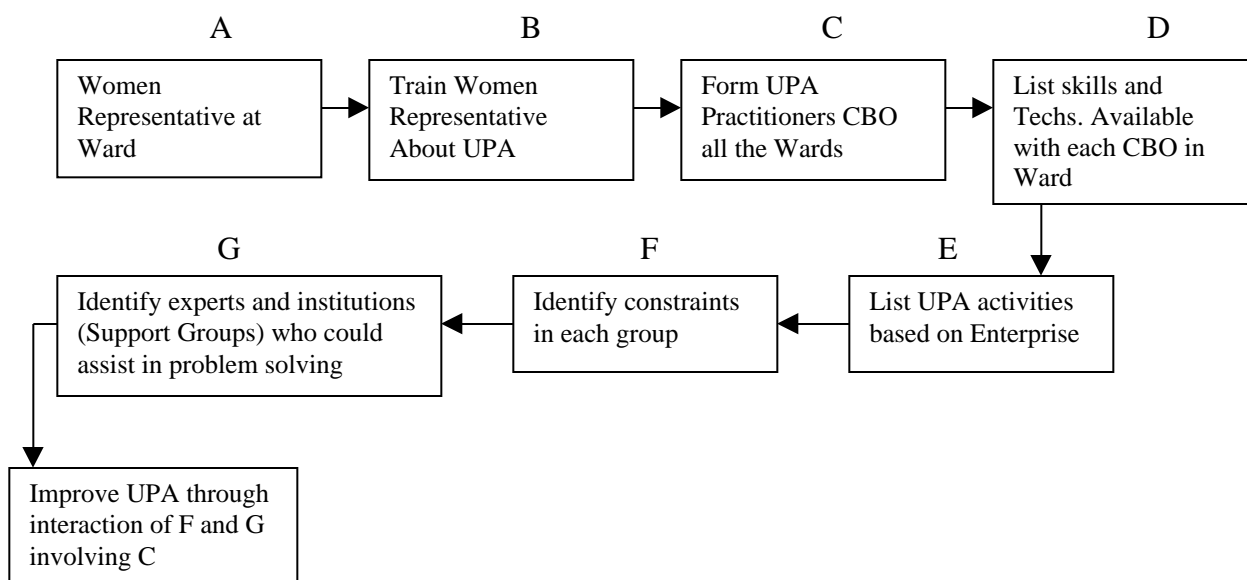
In a country like Nepal where UPA is a tradition, it is accepted as a part of daily life; therefore no formal research has been conducted about it. The government authorities, universities, and development institutions have to abandon the previous concept about UPA and treat it like a vibrant and dynamic activity essential for the benefit of the expanding cities and the millions who live in them. Research and development studies on UPA must become an important component in overall agriculture and natural resource management and social and economic development sectors.

F. Extension Strategies for UPA development in Nepal

Urban farming is most common in the high density areas because food becomes the first priority in such places. Urban farming is more a necessity of the urban poor because they have to spend 50-70% of their earnings on food. Women who have to be responsible for processing food for the family are the primary practitioners. Therefore, it is essential to involve them in any development strategy.

The following extension strategy would be appropriate to improve UPA in Nepal

- a. Identify the women representative of the ward and nominate her as the coordinator.
- b. Provide necessary trainings about UPA to all the representatives.
- c. Form a UPA practitioners organization in all the wards of the UP areas.
- d. List available technologies and identify resources associated with UPA at the ward level.
- e. List the UPA activities based on enterprises; and designate sub-groups with expertise.
- f. Identify the strong points and constraints of all the sub groups at the word level.
- g. Identify the experts and institutions who could provide the skills, technology and finances to eradicate constraint and improve UPA at each ward level.



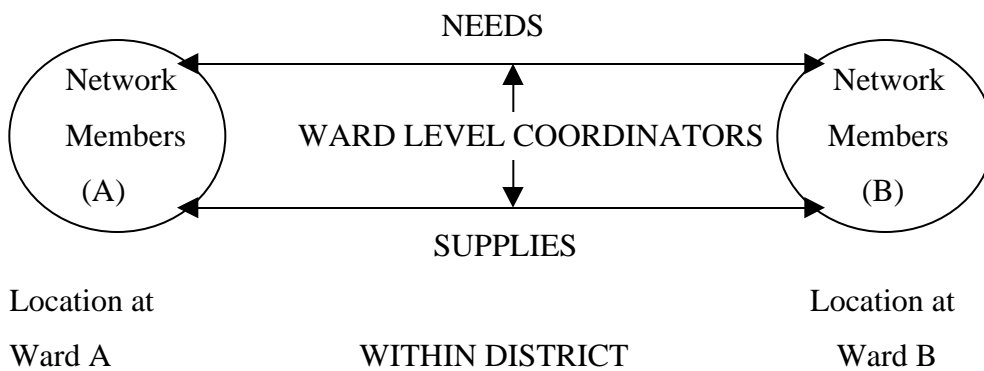
The idea behind selecting the woman elected representative in the ward as coordinator is to (a) involve these representatives in productive programmes (b) raise the voice for the UPA practitioners during policy discussions (c) get support from government authorities for UPA development (d) have a strong supporter for the programme in the local level decision making lobby (e) improve the working condition of the urban women who form the majority of the UPA practitioners (f) include UPA as a priority sector in all local government programmes when the decentralized form of government starts to function (g) ensure the existence of UPA activity in each ward by strengthening its public base.

Women representatives are elected in local elections. They are well known amongst all the inhabitants. Therefore it will be easier to implement any programme. They will be mostly unaware about the UPA benefits and potential of initially but will get a grasp on the subject when appropriate training is provided to them.

G. Networking

Networking will be useful amongst UPA practitioners. Networking will assist in sharing skills, knowledge and materials. A major constraint expressed by 79% respondents was the lack of good planting material or seed. Network members can help one another. The identified UPA ward coordinators can meet twice a month and exchange information to help ward level network members. They can also publish a

network newsletter to disburse information including news about needs and supplies from members. Members who have excess amount of specific supplies (ex. Improved seed can sell it to others who are in need of it). The information could be channeled through their ward coordinators who would present it in the monthly meetings. Networking will be effective in the development of UPA in Nepal because the government agricultural development strategy includes the identification of "pocket" areas and the formation of CBOs and community groups (CGs) of like-minded UPA practitioners. There could be networks amongst pocket areas, or amongst CBOs and CGs. To start with, networks must be formed within districts first and then expanded to between districts to make them effective but manageable.



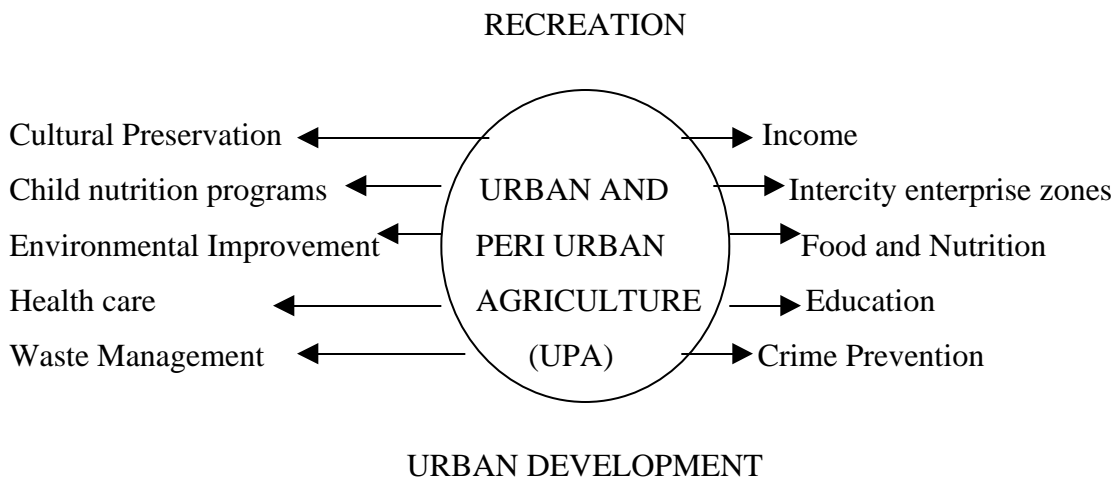
(A) and (B) are similar activities performed at Location A and B. Ex. Vegetable Farmers at A and B Locations.

This is similar to the intercity enterprise zone concept. This ward level concept goes to the smallest administrative unit. Active UPA groups formed at the ward level will be useful and helpful to collect scientific data about urban and peri urban agriculture in Nepal. We have already mentioned before that there is no reliable data about UPA in Nepal. This is a major constraint in its development. Lack of information is also a factor which has deprived UPA of the attention of the authorities, planners and policy makers.

H. Attitude

A very comprehensive report has been published by IDRC (Canada); http://www.idrc.ca/cfp/rep09_e.htm titled Promoting Urban Agriculture: A strategy Framework for planners in North America, Europe and Asia. This report, prepared by Paul Summers and Jac Smith could be used as a guideline for understanding and development of UPA in Nepal. The report concludes "cities that have urban agriculture programmes need to expand them. Those that don't need to start. Perhaps no other activity touches so many aspects of urban life. The benefits of Urban agriculture are known. With effective planning urban agriculture can grow and blossom into its full potential" Nepal has urban agriculture, with effective planning it can blossom and provide benefit to millions who live in cities and to those who continue to pour into cities every year.

Upto the present, UPA has received the least importance in government and development planning. There is a need to study about the benefits and constraints of UPA in detail for planning purposes. The proposed formation of ward level UPA, CBOs would be the starting point for this study. These ward level CBOs could provide useful information about the various facets of UPA in their areas. This could become the foundation on which future research and development plans could be built upon.



The many advantages from Urban Agriculture – From IDRC's CFP Report Series Report no. 9

The above diagram shows the diverse areas which are supported by UPA. UPA research must be addressed by a multidisciplinary institute which can assume responsibility for all facets of urban agriculture.

CHAPTER - II

TECHNOLOGIES THAT HELP URBAN PERI URBAN AGRICULTURE (UPA)

This chapter of the training manual will try and present information which the respondents were eager to obtain; which they thought would be helpful to improve the production from the small pieces of city land where they were growing food.

A. The Traditional Urban and Peri Urban Farmers

Producing food for the family is the primary cause which dictates the actions of the urban and peri urban farmers. The first goal is to produce enough for the family if possible and the second is to maintain the productive capacity of the small farm. The maintenance of the productive capacity of the land assumes great importance because only then can small farmers continue to produce food for the family and future generations. In order to succeed, the farmer has to continuously innovate new techniques and codes. The actions of the urban and peri urban farmers have tried to keep pace with new demands, opportunities and requirements of the non-farming urban population. Many traditional farmers have gone "commercial" taking advantage of the technological advancement in farming. Despite the rapid progress and great diversity observed in UPA, there remains the unchallengeable truth that the primary fundamental is obviously the SOIL. Except in very rare cases where sophisticated systems like hydroponics are used to grow food, the soil is the life and soul of the urban farmer so we begin the chapter with the soil.

B. The Soil

This is the material in which plants grow. Soil is a mixture of mineral and organic matter. Most of the organic matter remains in the top layer; immediately below this layer is the upper sub-soil, below this the lower subsoil, then a layer of broken rock then below this the bed rock.

	Organic matter
	Upper subsoil
	Lower subsoil
	Broken rocks
	Bed rocks

Plant roots grow below to the sub soils and absorb nutrients from there as well. The top soil is full of mineral matter too. Except peat and muck soils, any soil which contains 10% organic matter (OM) on a dry basis is usually a very "rich" soil. Most of the very productive urban and peri urban soils however do not contain more than 3-4% OM. These figures are important figures to be remembered because this low percentage of OM in normal soils necessarily means that the percentage of mineral matter is correspondingly high. It is exceptional soil which is low in mineral matters.

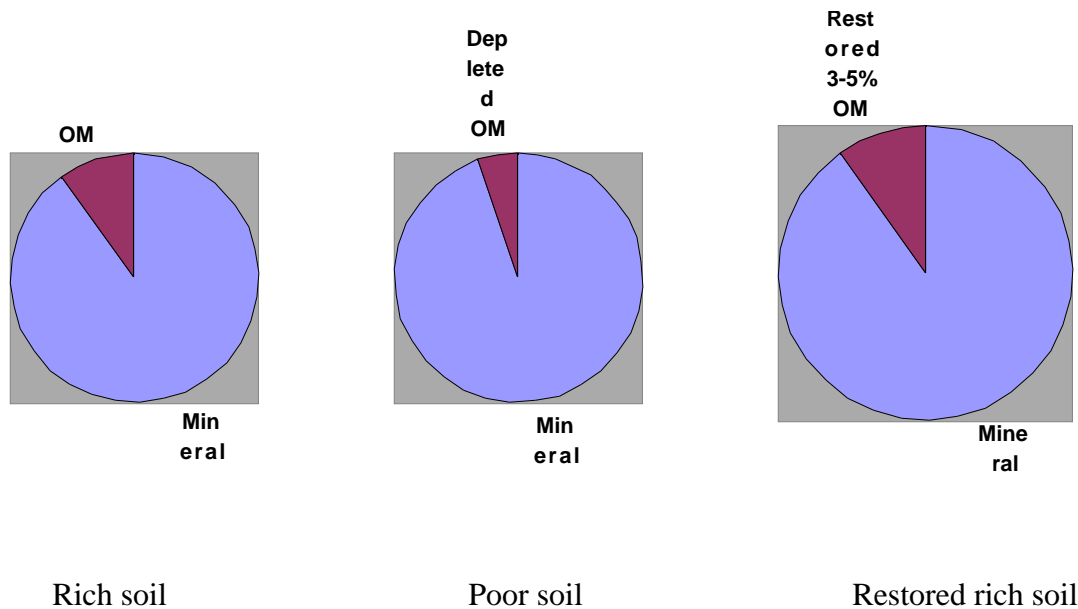
In urban plots which are constantly under cultivation, organic matter is continuously breaking up and being used up. Excessive use of such lands with no addition of organic matter (OM) converts then into "Worn out soils". These soils are however still rich in mineral matters. When we analyse the soils from land abandoned as unproductive, we still find them richer in minerals, generally speaking, than that of farms which still produce bumper crops. The organic matter content in such soils however is very low.

When crops are grown and harvested season after season (like in intensely cultivated urban farms) from fertile soil with an original composition of let us say 5% organic matter (OM) and 95% mineral matter, the organic matter will be steadily depleted to around 1%. Then the mineral content will be 99%. This is why intensely cultivated soil will (despite the high mineral content) get less productive. Addition of more minerals to mineral rich soils is a waste. The only way to restore the intensely cultivated urban soil to its original fertility is by the addition of organic matter to raise its organic matter content.

Organic matters like manures, composts, fallen leaves, straw, vegetable wastes, animal wastes all contain minerals which are, necessarily, those that are needed for plant and animal life. It is essential to add OM to the "sick" soil to restore it because when we

add OM we are simultaneously adding minerals to the soil too. The urban farmer therefore must obtain organic matter and add it to his soil regularly because without it the soil he cultivates gets worn out and his production continues to decline. Mineral fertilizers must be used sparingly and only when it is essential to obtain extra ordinary yields.

The organic farmers therefore must include composting and other methods of waste recycling techniques in their farms to maintain soil fertility and soil health. A fertile and healthy soil is the key to abundant and plentiful production from the small piece of urban agricultural plot.



The soil is rich due to its organic matter content and not due to its mineral content.

C. Maintain Soil Fertility in Urban Farms

Many urban farmers we interviewed had complained that the productivity of their land was decreasing despite the large amount of chemical fertilizer they were using. WE have explained in the previous chapter the importance of organic matter to the soil. The urban farmer must maintain a high level of organic matter content in his soil to keep his

soil fertile. The urban farmer cannot completely discard the addition of OM to the soil and use only chemical fertilizer to maintain fertility. The organic matter added to the soil triggers a host of activity. What looks like simple decay is in reality, a process of reconstruction of the damaged soil. It is the build up of the battered and bruised soil to provide food for another generation. Millions of micro-organisms attack the organic wastes added to the soil and convert this "useless" commodity to a store house of nutrition and energy storing compounds which will nourish the coming generation of plants. The acids produced during the decomposition process dissolve minerals present in the soil and prepare them as food for the crops which will be planted.

Urban farmers in the past understood the value of adding urban waste to their soils. The wastes of living people and animals went back to the soil. Generation after generation of crops were grown on the same piece of land and the soil retained its fertility.

About 100 years ago a new doctrine was introduced which said plants needed only certain elements and crop yields could be increased if these elements were added to the soil. The scientist who introduced this doctrine was not a practicing farmer but a chemist. He had reached this conclusion after analyzing the plant parts in his laboratory. The chemical industries took up this forecast and the NPK mentality was born.

NPK did show remarkable results, crops were prodded to rapid and spectacular growth. These chemicals also stimulated the growth of micro-organisms in the soil and the breakdown of organic matter was speeded up giving temporary boost to production. As the soil lost its organic content, yields ultimately fell and the soil was dead.

When NPK is added without proper planning it disrupts the natural balance in the soil which results in all kinds of other problems. There is a tendency of the plants to crave for more NPK in subsequent years. Plants also show other deficiency symptoms. The trace element era is born.

The old time farmer never experienced trace element deficiency in his urban plot because the trace elements were made available by the organic manures he had applied to his field regularly. Excessive use of chemicals and fertilizers with their negative effect on the soil organic matter content is the biggest problem faced by the UPA farmer today. Every UPA farmer must think of the wisdom of their ancestors who, through an efficient

system of urban waste management, kept their cities clean and also managed to maintain a high fertility level in their farms.

D. Preparation and "Repairing" Soils In Urban Agricultural Plots

We have tried to explain why organic matter is so important in an intensely cultivated urban plot of land. Many prominent soil scientists have written volumes describing the value of organic matter Dr. Firman E. Bear of Rutgers University has said "Organic matter is a very important part of a fertile soil and purely inorganic fertilizers will not take its place directly".

Dr. Richard Bradfield of Cornell stated "The maintenance of a good supply of Organic Matter in the soil is one of the basic objectives of good soil management. The proper use of organic matter cannot be over estimated".

The National Fertilizer Association of USA has published an advertising booklet entitled "Organic Matter – the life of the soil". It is stated in this booklet that "soils that are low in organic matter usually produce poor crops". Organic matter is therefore the key to a good, healthy and fertile soil. The UPA farmers must be coaxed and supported to add as much organic matter as possible to repair their damaged and exhausted soils.

E. Where can the UPA Farmer Get the Organic Matter He Needs

One of the first thing the urban farmer asks when he is told to apply OM to his soil is where could he get all the OM he needs ? There are many ways the UPA farmer could add OM to his soil. Some of the ways suitable for them are: (a) green manure (b) Manure (c) Compost (d) leaves (e) sheet composting (f) other urban wastes.

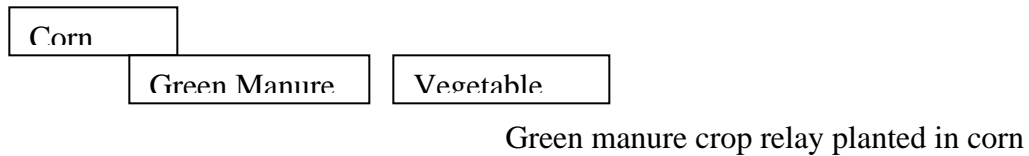
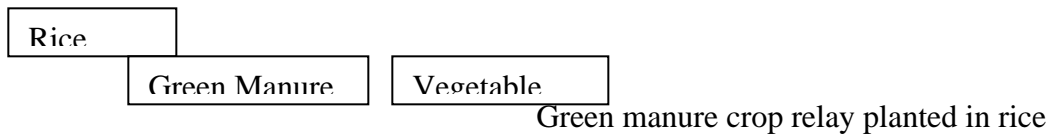
a. Green manures

The small plots which are used to grow food in urban areas are cropped continuously to obtain food throughout the year. The farmer cannot let the green manure crop replace his food crop even for a short period. The farmer can however include a green manure crop in his planting pattern. The best example is the corn soybean intercrop systems still prevalent in many urban plots, where the green pods of soybean is harvested as a vegetable and the green plant is allowed to decay.

The typical cropping pattern in many urban plots in Nepal is:

Rice	Vegetables	(Lowland)
Corn	Vegetables	(Upland)

This leaves very little time for the green manure crop to be included in the pattern because there are vegetables which are harvested just a few weeks before the plantation of corn or rice. The only possible method to include a green manure crop in this pattern is to relay broadcast a green manure crop and incorporate it in the soil when the land is prepared for corn or rice.



The inclusion of the green manure crop in the system will boost the vegetable yield in the pattern.

b. Manures

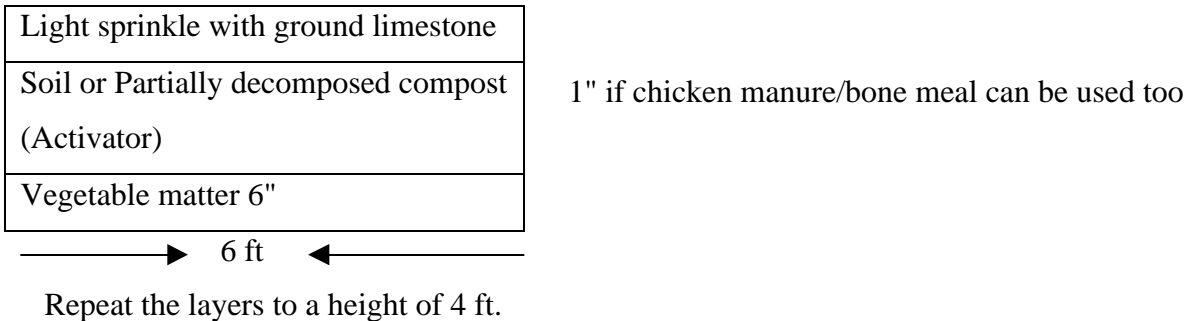
They have great fertilizing value, therefore all urban farmers must try to get their hands on this substance and use it in their plots. The best way to get farm yard manure is to be in touch with someone who raises farm animals in the neighbourhood. The animal farmer will be happy to sell his farm yard manure because disposing animal wastes is a major problem in urban areas. Manure value is enhanced because it is the most commonly used substrate for compost making and in vermiculture too.

c. Compost

The application of properly prepared compost to the soil can give astonishing results. These soils produce healthy plants which can fight against diseases and pests better. The disease and pests attack weak and under nourished plants much more easily.

Firiend Sykes the famous British farmer, has written in his book, Food, Farming and the Future that compost making is so important that it is worth a lot of thought and effort on the part of any farmer. Most small urban farmers are aware of the value of the compost. Many however complain about the lack of space in their back garden which can be allocated for the compost heap. Fourty four percent of the vegetable farmers would be interested to know ways in which the time needed to make the compost could be shortened. The following methods have been recommended by various authors.

1. Leonard Wickenden, the famous flower fruit and vegetable gardener has recommended the following steps in his book Gardening with Nature, the Organic Gardener's Bible.



There are two stages during the compost making (a) aerobic (b) anaerobic. There must be plenty of air during the first aerobic stage, so the compost heap must be aerated and moist. The second stage is the anaerobic phase, where the organisms do not need air. If care is taken to provide this optimal condition during phase I and II, the time for composting can be reduced considerably.

Compost can be made using wood frames. The following diagrams describe methods are effective.

The other important factor with compost is that many harmful organisms are killed when compost is made. The following table given in a World Bank report titled "Health Aspects of Excreta and Sullage Management" presents the following fact.

Table : Pathogen Survival in Composting and Agriculture Application of Human Wastes.

Organism	Composting Survival in	Agricultural Application
Enteric viruses	Killed rapidly at 60°C	May survive upto 5 months on soil
<i>Salmonellae</i>	Killed in 20 hrs at 60°C	<i>S. typhi</i> survives upto 3 months other spp. Upto 1 yr.
<i>E.coli</i>	Killed rapidly above 60°C	Several months
<i>Cholera vibrio</i>	Killed rapidly above 55°C	Not more than 1 week
<i>Leptospires</i>	Killed in 10 min. at 50°C	Upto 15 days on soil
Hookworm ova	Killed in 5 min at 50°C and 1 hour at 45°C	Upto 20 weeks on soil
<i>Ascaris ova</i>	Killed in 2 hrs. at 55°C Killed in 20 hrs at 50°C Killed 200 hrs at 40°C	Several years
<i>Schistosome ova</i>	Killed in 1 hr. at 50°C	Upto 1 month if damp

How to Shorten Composting time

Mr. Fowler, an agriculturist of repute, developed this technique in which fresh materials are incorporated in an already fermenting heap so that quicker decomposition can be obtained with already established microbial population. He suggests not to remove the compost completely from the pit or heap but to leave a portion behind and mix the new material with it every time.

d. Vermiculture Biotechnology

Darwin (1881) showed that earthworms affected soil formation for the first time. He also proved that earthworms enhanced soil fertility. The main role of earthworms is to convert the waste materials present in the soil into value added products. Vermiculture is the art of raising earthworms. Vermiculture has been successfully used all over the world to improve the quality of the soil. Four varieties of earthworms are available in India and are called manure worms. They can be cultured and raised on animal dung, poultry excreta, vegetable and other types of bio-degradable wastes.

The earthworms are important partners in soil biology and functions. They help beneficial soil microflora to multiply, destroy harmful pathogens, and convert organic wastes into valuable bio-fertilizers (SP Planiappan and K. Annadurai, 1999). The soil enrichment at locations with high population of earthworms is due to the speeding up of mineralization of organic matter 2 to 5 times its normal rate. Earthworms accelerate the formation of soluble and available N, P and K. Earthworms will prove valuable allies to the urban farmers because they help maintain soil fertility. They also play a crucial role in urban waste management.

Preparation of Vermicompost

Vermicompost means compost from vermiculture. Vermicompost can be prepared in the following manner.

Requirement: Containers where the worms will be raised. A container of 1 m x 1 m x 0.5 m volume can accommodate 1200 – 1500 worms.

The Culture Bed

A bedding layer at the bottom of the container, the layer (may be of any bio-degradable material) can be 2.0 – 4.0 cm thick. The second layer is about 5.0 cm thick, this layer is partially digested cowdung. The two layers are moistened to a moisture content of 30-40%. The worms or their cocoons are introduced into the container.

Food for the Worms : Dried cattle, sheep, horse, pig dung, poultry droppings, vegetable wastes or other degradable domestic wastes are ideal food for the worms. Cattle dung can be used alone or mixed with other wastes at 1:1 ratio. Best results are obtained if wheat bran, grain bran and vegetable waste at the rate of 10:11:1 is added to cowdung. This will enhance the quality of the compost and improve the multiplication of the worms.

When worms are added into the container with worm food, the worms start the "digestion" process from the top and move downwards. As they do so they leave a mass of well digested rich "Wormcasts". This is in actual fact the compost. This wormcast must be removed periodically and collected to be used as fertilizer for plants. When the casts are removed, fresh feed materials should be supplied immediately for to the worms.

Earthworms, under proper conditions, consume almost any non-toxic organic waste including food processing waste, paper, manures and sewage sludge. Earthworms, can therefore become the best managers of domestic wastes. These creatures can convert household wastes into valuable fertilizer and, at the same time, greatly reduce the amount of urban waste which litters the streets.

Poor urban households can raise earthworms in their backyard gardens by digging shallow pits (instead of the container) and applying the composting material and worms as described above. They can remove the casts from the surface when appropriate and add new material when needed. This management is simplified because the worms feed on the upper layers and move towards the bottom when the composting is complete. They move to the surface again when fresh material is added thus repeating the composting process again and again at the same place.

e. Leaves and Sheet Composting

Special mention on leaves as a fertilizer material is highlighted. Leaves are the discarded portion of many types of vegetables. Tons and tons of this substance are available in all major vegetable markets. It is also a serious pollution problem in urban areas deciduous plants planted along the roads for beautification shed their leaves and dirty the environment as well. Leaves have a very rich fertilizing value. Leaves decompose slowly when they are heaped and allowed to decay naturally; but mixed with other vegetation and when used in compost pits/heaps they are a valuable addition. Leaves can be used in sheet composting, specially around fruit trees, in flower beds or vegetable gardens.

In cold areas, leaves mixed with chicken droppings or animal dung and spread on the field gives a perfect winter coat to the soil. This substance gets thoroughly mixed with the soil when the land is prepared for the spring crop. It can save a considerable sum for the farmers who can reduce the amount of chemical fertilizer used in their farms.

f. Other Wastes

Aquatic weeds of different types are rich in nutrients including trace elements. These water weeds can be combined with other readily available wastes like garden

weeds, spoiled hay, and various domestic and industrial wastes to get good composting materials for the urban peri urban farmers. A basketful of dried aquatic weed added to the compost heap improves its quality and adds trace elements to its composition.

The small urban farmer can maintain the fertility of his field by recycling the waste materials available to him both at home and in his neighbourhood.

F. SEEDS, SEEDLINGS AND PLANTATION

Many urban farmers we have interacted with complained about the lack of availability of good seeds. They also mentioned that there were not enough good quality seeds for planting. Our observation showed that to the urban farmer planting crops on his small plot of land the quality of the seed was more important than the quantity. The other major problem expressed by them was the quality of the seedlings and the mortality of the seedlings after transplant.

The government nurseries are not able to meet the demand for good quality seeds of species preferred by the farmers. The most appropriate method of meeting seed demand is through seed exchange amongst the farmers themselves. The second alternative would be to encourage some member to concentrate wholly on seed production to supply seeds to the neighbourhood farms. Private farms established by retired agricultural professionals and other civil and military officers can also be a good seed source. We would recommend that farmers themselves identify a good seed source for themselves and request NGOs, INGOs support to make it sustainable.

Problems with Seedling Production and Survival of the Transplanted Seedlings

Some of the farmers (specially Women who have recently started urban farming) complained about the different problems with seedlings and survival of the transplanted seedlings.

Many experts have mentioned a number of simple conditions which affect seedling production and plant mortality. These will be summarized below.

- a. It is important to use good, healthy and pure seeds.
- b. It is important to prepare a good seedbed.
- c. It is important to maintain good moisture condition in the seed bed.

- d. It is important to maintain a good stand of seedlings in the bed.

Good healthy seeds are the key to a good healthy seedling because the recently germinated seedling is nourished by the nutrients available in the seed. A sick infant can rarely grow into a robust plant. Sick seedlings are a waste of effort. Therefore a wise gardener must pay equal attention to the seed as to all other factors.

The second important factor is the seedbed. The seeds must be sown on a "soft" bed which retains moisture, which does not allow abrupt changes in temperature, and which has abundant available nutrients. A seed bed with liberal amount of compost in it would be ideal. Composts have antibiotic characteristic which can destroy harmful bacteria which affect very tender seedlings, specially their roots. Soil moisture is important to initiate germination and growth of seedlings. Too much soil moisture is harmful to young seedlings and one major cause of the damping off.

The other factor which has been found influential to seedling production is the population of the seedlings. Too much crowding is bad, so is too few plants.

Leonard Wickenden, has described the following three troubles as the most common with seedlings :

- a. **Legginess** : Plants grow spindly and are not sturdy: caused by high temperature or too much moisture, in-sufficient sunshine or over crowding. Remedy: sow in bright warm areas, keep soil moist but not wet, do not over crowd.
- b. **Crooked stems** : This is due mainly to uneven exposure to sunlight and over crowing. This problem is overcome by providing equal exposure to sunlight and also by sowing optimum amount of seeds. Do not crowd the seedlings in a small area.
- c. **Damping off** : May be caused by a fungus. The best remedy for this ailment is to prepare the seed bed with liberal application of compost. Over watering must be avoided at all cost.

G. Transplanting

Many vegetable farmers specially the new ones we met complained about the high mortality of the transplanted seedlings. The problem was more severe with out of

season vegetables. The main reason for this can be the "shock" experienced by the young seedling which is transferred from the controlled environment of the green house to the harsh environment of the field. We recommend a hardening period for such seedlings before they are moved directly to the field. The appropriate approach would be to remove the "plastic cover" and let the seedlings grow under the normal temperature and atmosphere for a certain length of time before they are moved to the actual planting area. Seedlings are removed from seed beds and transplanted into their planting areas primarily to give them space where they can mature into an adult plant. One hundred percent survival has been achieved if.

- a. Seedlings are transplanted in the evening or on a cloudy day with possible shower after that.
- b. Transplant seedlings in a well prepared field with loose soil to allow root development and with plenty of manure for supplying young plants with enough food.
- c. Remove the seedlings from a moist seed bed to avoid damaging the root of the young seedling. If the seedbed is dry, water it a day before the seedling is removed.
- d. Plant the seedlings in large holes with plenty of space for the root to develop properly. The planting holes must be deep too to prevent the roots from bending.
- e. Before planting the seedlings, fill the holes with water if practicable.
- f. Dig the young seedling with lots of soil around it, dig deep, dig wide.
- g. Place the plant in the hole prepared for it, hold it straight and fill up the hole with soil having liberal amount of compost in it until it is well filled. This is very important. There must be a good contact between the soil attached to the seedling and the soil which is used to fill-up the hole. If it is a bare root plant with no mud ball, make sure that there is good firm contact between the root and the soil in the hole. This is achieved by a hard press.
- h. Apply a good amount of water.
- i. If the weather is hot and dry, provide shade to the newly planted seedling to protect it from the heat.

If the above mentioned steps are followed properly, there will be no mortality of the seedlings and a healthy harvest is possible.

CHAPTER - III

A. PLANT PROTECTION

Indiscriminate use of harmful chemicals has become a common occurrence in many urban and peri urban farms. Our survey revealed that even the most basic plant protection principles have not been followed when planning plant protection programmes. Farmers prefer to rush to the nearest shop selling the concentrated chemicals and ask for advice from the shopkeeper. The trader recommends a combination of sprays or application without ever trying to know the kind of or magnitude of the infection or attack. Eighty nine percent of the farmers rushed to the agro-vet shop at the first instance after noticing some insect on his crop. They did not know whether it was insects which were useful or beneficial. Their approach is to spray chemicals if the insect is present.

We have also observed farmers spraying concentrated dose of insecticide and fungicides on young seedlings and marketable vegetables growing together in an intercrop system. This scene is very common when cauliflower seedlings are relay planted in between rows of leafy brassicas which are almost ready for market. The farmers could have economized by spraying the cauliflower seedling only but he was not aware of this. In many small urban plots physical control is sufficient if a few hours are spent in the garden every week. But the foremost and important factor to consider while pest management is planned is to be able to identify the useful and harmful insects.

Powerful sprays have destroyed many natural predators and enemies of harmful pests. More frequent application of the chemicals has become a common practice in many farms now. The danger this practice presents on the health of the consumer cannot be exaggerated. There are some simple but effective pest control measures which will be useful and safe. These are described in the following pages.

- I. Learn about the insects which we see every day in our garden. Know whether they are useful insects or harmful ones.
- II. If they are useful ones, help them multiply but if they are harmful see if they are only a few in number. If they only are few, then just pick them one by one and destroy

them in the simplest way. If they are numerous, then one of the following methods may be used.

- A. Nature provides many enemies which destroy harmful insects. They either destroy the insects completely or keep the population so low that they do not cause any significant damage to the crop. The following are some common "friendly" insects
 - (a) The Tiphia
 - (b) The aleochara
 - (c) The Lacewing
 - (d) The ladybird beetle
 - (e) Praying mantis.
- B. Many traditional technologies are still applicable for pest control. These techniques will be adequate for the small urban vegetable grower who grow their crops in a few square meters of land. Some techniques are described.
 - I. The yellow traps : Many insects are attracted to yellow objects. If we hang yellow cards with a coat of transparent sticky substance, the insects sit on the cards and are trapped (source ECHO).
 - II. Light Traps : Lights attract insects at night. Flying insects are specially attracted to bright lights. Simple kerosene lamps are hung on wooden frames anchored firmly in the ground. A shallow bowl of water is placed immediately below. A few spoonful of oil is added to the water to trap the insects more effectively when they fall into the water. Many harmful insects like (a) the American bollworm (b) army worms (c) brown rice plant hoppers (d) cutworms (e) green rice leaf hoppers (f) rice gall midge (g) tomato horn worm are trapped successfully using light traps.
 - III. Decoy crops : Pests are more attracted to certain crops than others, the best example is the cotton bollworm. This insect is more attracted by the corn plant than cotton. Therefore a few rows of maize in between cotton rows keeps this insect away from the cotton crop. Decoy crops and trap crops have been successfully used against nematodes. This table from the ILIEA

publication "Farming For the Future" will be useful to UPA farmers and is reproduced here,

Crops	Nematode spp.	Decoy crop.
Egg plant	<i>Meloidogyne incognita</i>	<i>Togetes patula</i>
	<i>Meloidogyne javanica</i>	<i>Sesamum orientale</i>
Tomato	<i>M. incognita</i>	<i>T. patula</i> ; castor bean
	<i>Pratylenchus alleri</i>	chrysanthemum
Lady's finger (Okra)	<i>Meloidogyne spp.</i>	<i>T. patula</i>
Soybean	<i>Ratelenchus spp.</i>	<i>T. minuto</i>
	<i>Pratylenchus spp.</i>	<i>Crotalaria spectabilis</i>
Oats	<i>Heterodera avenae</i>	Corn.

Source: Farming for the Future; A ILEIA Publication.

The very common sunn hemp plant attracts many insects. It is most advisable to grow rows of sunn hemp around your plots so that insects are kept away from your crops.

- IV. The Neem Plant : Volumes have been written about the use of Neem in pest control. The active substance which has insecticidal properties is concentrated in the seeds. Other parts like leaves are used too. The active substance found in the Neem plant inhibit larval development, reduce female fertility in insects, acts as repellants, and antifeedants. The compounds are very effective on beetles and their larvae; caterpillars, grasshoppers and locusts. Aphids, scales and white flies are controlled too. Neem oil, water extracts, powdered seed/leaves are all effective on specific insects; (ECHO).

Neem will not have any effect on the feeding habit of slugs. This was reported from England (Hort Ideas, March 1992 pp.33).

- V. The following useful information was published in the UNICEF Home Garden Handbook.

Plants that may help repel insects

Plants	Insects	
Tomato	Flea beetles	Integration of one of these plants in the planting pattern would prove useful when a particular insect is noticed in the area.
Hot pepper	Chewing insects	
Garlic	Cabbage butterfly	
Marigold	Aphids and weevils	
Petunias	Aphids	
Wood ashes	Ants, aphids, beetles, Crawling insects	

Two home made sprays which can substitute chemical sprays in the small gardens can be made in the following way:

a. Insect repellent

1. Materials needed: Mint, tobacco leaves, hot pepper, garlic, onions, tomato leaves.

Grind the plant parts to extract the juice and mix with water in a 1:1 ratio.

Another spray can be made of soap, Kerosene and water.

For 1 litre of mixture

Quarter cup laundry soap

Quarter tablespoon kerosene

One litre water

Mix and apply

b. Contact Poison (for sucking insects)

1. Materials needed: One pack cigarette; two eggs; eight table spoon oil, two cups water, three glass jars; pinch of detergent soap, two empty cans.

Remove paper from cigarette and put tobacco in the empty can. Add 2 cups of water boil for 15 min. Filter and put the liquid in one of the glass jar. Put eight spoons of oil and two spoons of vinegar in the other can, add two eggs and beat till they emulsify. Mix this with the nicotine and put this mixture in the glass jar. Add the detergent and spray.

A publication from ECHO (USA) has mentioned *Tephrosia vogelii* (fish bean) which has been used successfully to control many kinds of insects in the small farms. Agriculturists who tried *Tephrosia* extract as an insecticide against caterpillar have found it equally effective as malathion. *Tephrosia* is a good manure too. Hundred grams of dried *Tephrosia* leaf powder mixed with 100 kg of maize controlled the maize weevils and other maize seed borers. If the same amount of powder is mixed with 100 kg of beans it controlled bean bruchids. Emmanuel Solo, an extension worker in Tanzania (Africa), reported that the effect of *Tephrosia* leaf powder as insect repellent remained for upto 3 months. *Tephrosia* plants are also useful to control ticks, lice, and flies. Leaves and young branches are pounded in a mortar. This is diluted with five times its volume of water and then applied to the animals.

The pounded stuff can also be soaked in water overnight or boiled for 30 minutes and used as insecticidal spray after adding a bit of soap to make it stick. This spray can be used on garden vegetables, fruits, and field crops to control termites, ants, beetles, aphids, cutworms, various types of bugs, weevils, stalk borers and flies. The advantage of *Tephrosia* is many fold so every urban farmer must plant this species in his garden.

There are many useful information about the use of non-poisonous chemicals or plant extracts to control disease of plants too. The Avant Gardener newsletter reports that ordinary baking soda prevents and cures powdery mildew on strawberries; egg plants, and cucumbers when sprayed weekly at the rate of $\frac{1}{2}$ oz per gallon of water.

Powdery mildew on pea was controlled by garlic oil spray; sprayed every two weeks. Moringa leaves when incorporated into the soil one week before sowing seeds

prevented damping off. The list can go on and on. Extension agents must find out the best non-chemical (not pesticides) insecticides and tell them to the urban farmer so that he can control the pests from his crops.

A full list of plants useful in pest control is presented in the appendix.

CHAPTER - IV

ORGANIC WASTE

Food, Fuel and Fertilizer from Organic Wastes

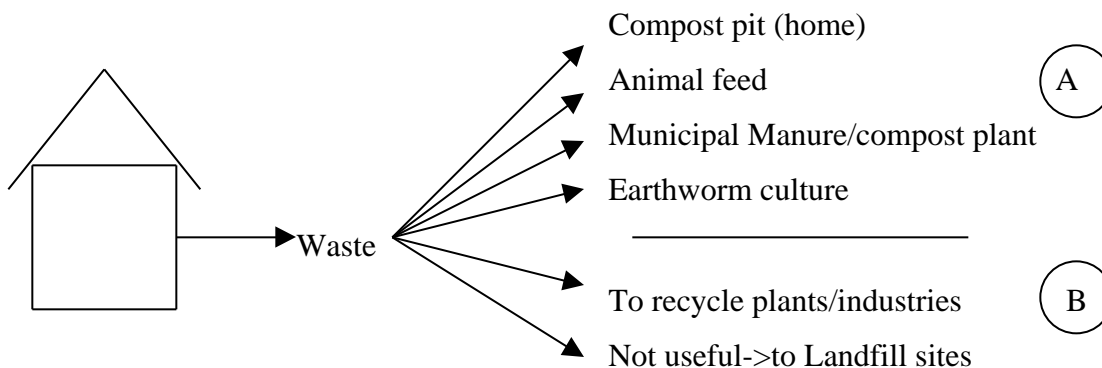
Organic wastes have been used very profitably in numerous countries to produce food, fuel and fertilizer. Some simple technologies appropriate to the urban, peri urban resident will be mentioned.

The quantity and quality of waste available at a given location and its composition help dictate its use. Slaughter house wastes if available year-round could justify the establishment of algal or fish culture.

Types of Wastes

Domestic Wastes : This signifies waste produced at home. This can be broadly divided into two main kinds (a) decomposable (b) non decomposable. To the average urban inhabitant the former kind is useful because he can reuse it in different manners while the latter will not be of much use because complex and complicated processes are needed to make them useful.

Decomposable wastes which are produced at home are dumped in the roughage heaps which litter the streets and are a major cause of pollution. The solid waste management department of Kathmandu Municipality report that 70% of the average domestic waste produced in the valley is decomposable. Public awareness is very important when waste management strategies are implemented. The following diagram presents simple steps appropriate to the urban house hold.



A = decomposable matter.

B = non decomposable matter

NGOs/INGOs and voluntary organizations must educate the family members to:

(a) Separate household waste into two types

(i) those which decompose easily and can be used to make compost at home, fed to the domestic animals, as food to the earthworms or this type could be dispatched in the municipal garbage trucks to the city compost plant if there is no possibility to use it at home.

(ii) Those items like plastic and other materials which do not decompose easily but can be recycled and used must be disposed in the municipal separation areas. There they are separated from non recyclable materials. The recyclable ones are sent to the recycle industries to manufacture as useful items. The useless stuffs are sent to landfill sites. This approach will greatly reduce street litter; make useful materials from garbage, and increase the duration of the landfill.

NGOs, CBOs and other community related groups must take the lead to initiate domestic waste management programmes. The city authorities must provide the financial and material support to households. The government must provide land to the municipal authorities to establish the compost industry.

Animal Wastes : Some new ideas are presented here. These ideas are used extensively elsewhere but whether they can be adopted without dispute, we leave this to the practitioner.

(a) Animal manures as Animal Feed: A major problem faced by the urban animal raiser is manure as a major constraint while raising animals. Ways have been developed of recycling animal manures as animal feed. Ensilage can provide an effective, low-cost means of conserving nutrients in animal excreta (cattle, swine, and poultry) for refeeding. These organic wastes are more valuable as animal feed than as fertilizer (Food, Fuel and Fertilizer from Organic Wastes, National Academy Press, Washington D.C. 1981).

Animal wastes are conserved for silage use in a fresh, uncontaminated state without adding water. This should be mixed with sufficient dry fermentable matter to increase dry matter content to about 55%. The silo may be a box, a plastic bag, a trench, or a commercial air light silo. The manure + dry fermentable mixture is packed tightly into the silo to exclude oxygen and provide minimum exposed area.

A suitable ratio of blending cattle and swine wastes with dry feed is 60% animal waste to 40% feed. Poultry litter can be used as mixing ingredient to conserve swine and cattle excreta. When this mixture is prepared, the workable combination is 60 part swine or cattle waste, 20 part air dried poultry litter and 20 parts ground grain or hay or crop residue. This formula is known as "Wastelage". Wastelage can be fed completely to breeding cattle and when enriched with higher energy feeds it can be fed to growing and milking animals. Wastelage is usually deficient in Vit. A so this substance must be added. (Source: Food, fuel and Fertilizer from organic wastes).

Chemical Composition of Domestic Manures:

	Output (g/DM per day)	Content % (DM)		
		N	P ₂ O ₅	K ₂ O
Cattle	2000-8000	0.4-1.3	0.15-0.50	0.13-0.92
Pigs (growers)	580	0.2-0.9	0.14-0.83	0.18-0.52
Sheep	460	0.9	0.34	0.8-1.0
Horses		0.66	0.23	0.68
Hens	22	1.8-5.9	1.0-6.6	0.8-3.3

Source: Chamberlain's Milk Production in the Tropics.

Average food value of Poultry and Cattle Manure (%)

	DM	Crude protein	Crude Fibre	TDN	Ca	P
Poultry dehydrated	82-88	25 (12 true protein)	10-14	53	7-10	15-25
Liter	75-85	30 (17 true protein)	15	Variable	2.4	1.8
Cattle, fresh	59	23	45	Variable	Variable	Variable

Source: Chamberlains' Milk Production in the Tropics.

Animal manures and poultry litter have been used in other countries but a bit of caution is required when this is attempted here.

Liquid Fertilizer From Manure

- A. Liquid manure can be made from animal manures. The following things are necessary to make the manure:**

- a. A 50 kg empty gunny bag (b) any type of animal manure (c) Watertight pit or drum (d) a few rocks or bricks (e) water.

The liquid fertilizer is made in the following manner:

- i. Put the manure inside the bag and tie the mouth tightly
- ii. Put the bag (with manure) inside the barrel or pit.
- iii. Fill the barrel or pit with water till the bag's top is covered with water.
- iv. Place the rock or brick on top of the bag to keep it under water.
- v. Cover the container.

Remove the bag in 3 weeks. The liquid is then ready to be used as manure around matured fruit trees and well established vegetable plants. This liquid manure can be kept in containers and given to the neighbors who are interested. It can also be sold in the market.

B. From Chicken Manure (Chicken Manure "Tea")

Nathan Duddles, an undergraduate student at California Polytechnic University, placed fresh chicken manure in a burlap bag, tied a rock around it (to make sure it did not float) and put the bag + manure + rock in a 35 gallon bin. Nathan measured nitrogen in the tea" each week and found that maximum nitrogen was reached after only one week when 20 lbs. of manure was used. When the manure amount was increased to 35 and 50 lbs it took 3 weeks. Nathan also measured other nutrients in the tea made from 20 lbs manure after 4 weeks. He diluted the solution to _ strength and compared with a commercially available hydroponic solution. The findings were:

Substance	In "Tea"	In hydroponic Solution
Total Nitrogen	219	175
Nitrate	4	145
Ammonia	215	30
Phosphorous	54	65
Potassium	295	400
Calcium	6	197
Sodium	62	0
Magnesium	0	2
Iron	0	2
Manganese	0	0.5
Copper	0	0.03
Zinc	0.05	0.05

All major nutrients and zinc are adequate. The inadequate substances are usually present in the soil. Poultry manure "tea" is easy to make and is a valuable fertilizer in any small urban farm or garden.

Effective Micro-organisms (EM) solution has been recommended to shorten the time taken for the waste to be converted into compost. EM contains useful micro organisms in a liquid medium. This liquid when added to the waste helps increase microbial population which helps in the formation of compost. The application of EM to the decomposing material removes the foul smell from the "rubbish". Effective micro-organisms application also stops the bad smell which is common in poultry farms.

Other Common Animal Wastes

1. Slaughter house wastes

A major cause for pollution in many urban areas in Nepal. Makeshift slaughter houses are located along river banks and the blood and other materials are allowed into the river thus polluting the water and environment. Even modern slaughter houses which slaughter hundreds of chicken daily follow the same process for waste disposal. Slaughter house waste has been used effectively in other countries. Some simple processes are described.

A. Poultry : (Includes Hatchery Waste)

Poultry industry is one of the most rapidly expanding industries in Nepal. The demand for poultry meat and eggs are increasing annually, specially in the urban areas. Thousands of birds are killed everyday. The by-products from the industry are not utilized for economic benefit; but are allowed to litter the environment. Poultry industry by-products can be used successfully and some potential uses are described.

I. Common poultry industry wastes are:

Feathers (5%); Blood (3.5%); Offal: Heads (3%) Feet (4%) Inedible viscera (9%)

II. Hatchery Waste: Spoilt eggs, dead embryos, egg shells, unhatched chicks, diseased chicks, dead birds.

Useful products from wastes

Feathers:

- a. Hydrolysed feathers can produce feather meal. The quality of this meal can be improved when processed with blood.
- b. Bird feathers can be made into beds and pillows.
- c. Feathers can be incorporated into the soil where they decompose slowly and release nitrogen. Irrigated areas are more suited for this process.
- d. Feathers can be used to make decorative articles, dusters and the stiff ones to make shuttle cocks for a game of badminton.

Blood : Can be dried and mixed in animal feed. Coagulated blood is a good fish food. Blood when mixed and cooked with feathers produce good quality animal feed. Blood and feather meal has good amino acid profile and very good digestibility.

Offal : When offal is used for any purpose, it should be sufficiently boiled to destroy the harmful microorganisms which might be present. Dried offal meal can be mixed with feed concentrates. It can be converted into good quality dog food after simple processing. Cleanly dried offal is ground and mixed with other products to form pellets. Offal is cooked, ground and utilized as useful fish food.

Hatchery Waste : Entire hatchery waste other than egg shells is used in the preparation of by-product meal which is comparable to fish meal with respect to protein content. This meal has been used in poultry ration at 3% level without any adverse effect.

Poultry manure : Poultry manure "Tea" has been described before. Poultry manure can be used as animal feed. Caged poultry manure is a good feed supplement for pigs and poultry whereas deep litter manure has been used to feed ruminants. Manure is sun-dried to 10% or less moisture content. Dehydrated poultry manure has been successfully incorporated upto level of 15% in layer poultry ration.

Poultry farmers must initiate programmes where they re-use industry by-products themselves. If they have produced products which they do not require themselves but could be useful to others (like animal feed, fish feed, fertilizers), interested parties must be attracted to share the by-product. This will solve the waste disposal problem and reduce pollution. It will also economize the poultry industry.

Animal Slaughter House Waste

Goat's blood is eaten in different forms by the Nepalese. Blood from other animals can be used in the same way like chicken blood. Animal blood by nature is different than chicken blood. Therefore its processing is different too. It is beyond the scope of this manual to get into detail.

Fish Waste: Fish merchants expressed a desire to learn about fish waste utilization during our interview with them. Some simple techniques are described.

I. Fish emulsion fertilizer

- i. Place the fish scraps in a large container and add water.
- ii. Cover the top with cloth and wire net to keep out animals and insects
- iii. Put the container in a sunny location to ferment for 8-12 weeks.

- iv. Add some citrus oil or other scent to mask some of the odor.
- v. When finished, a layer of mineral rich oil will float on the surface and fish scales will have sunk to the bottom. Skim off the oil and keep in a tight fitting container (empty plastic oil jars with tight fitting lids will do just fine).
- vi. To use, dilute 1 cup of oil with 5 gallons of water. This home made fish emulsion will be rich in nitrogen, phosphorous, and many trace elements but generally low in calcium.

II. Fish Offal Waste constitute the major waste in fish markets in urban Nepal

Fish offal may be sun-dried or may be conserved as silage with the addition of fermentable carbohydrate. A useful manure was produced in the following manner by the Caribbean Industrial Research Institute: Trinidad. Raw fish waste and raw cattle manure are mixed with sufficient chopped sugarcane (other high carbohydrate materials can be used) to increase CN ratio to 20:1 and packed in bed. There is rapid lactic fermentation, the protein in the fish and carbohydrate in the cane is preserved for future feeding.

III. Mushroom Waste

Mushroom waste is a useful manure. Its quality can be improved if mixed with dried and powdered animal manure. When mixed with dried animal manure, mushroom waste decomposes more slowly in flower nurseries, and for use in floriculture garden and flower pots. The ratio of mixing can be 60:40 mushroom waste and dried cowdung; 80:20 in the case of poultry litter.

Agricultural by-products: (Crop residues)

Large number of literatures are available which describe their utilization so a brief presentation is given which can be useful to the small urban or peri urban farmer.

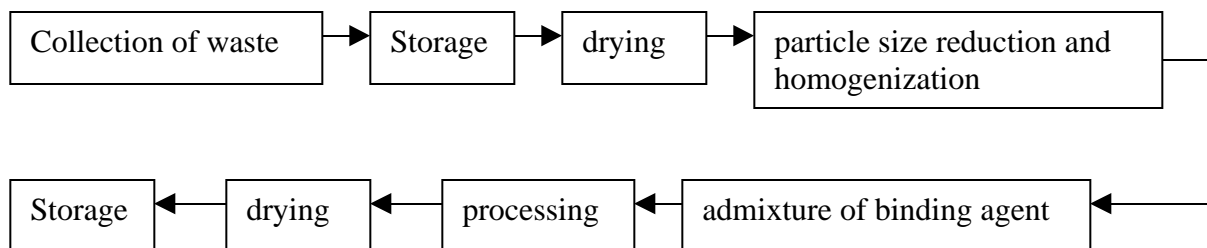
The major crop residue available to this group is vegetable waste or crop waste. Vegetable and crop residues can be used as animal feed, for compost making or vermiculture. Individual households have been found using this residue (leaves) to feed chicken raised in small wire cages or to one or two goats raised at home. Vegetable and

crop residue will continue to be the major source of animal feed for the many small animal farmers in urban areas. Eighty seven percent of the households who raise dairy cows at home near the major vegetable market feed them with vegetable market waste from this market. The number of families raising cows and buffaloes increased by 23% in the last five years when vegetable waste feed became readily available. Quality of crop residue, specially rice straw as feed, has been improved using various techniques like (a) alkali treatment (b) urea treatment. Physical processing like grinding improves the use of many plant products for ruminant feed. Grinding ensures better contact with micro organisms in the stomach and thus helps in digestion.

Fuel from Waste

Domestic heating and cooking fuel can be obtained from urban wastes. Two popular fuels are (a) bio-gas and (b) briquettes. Information on bio-gas is widely available so we will try and present some useful information on briquetting.

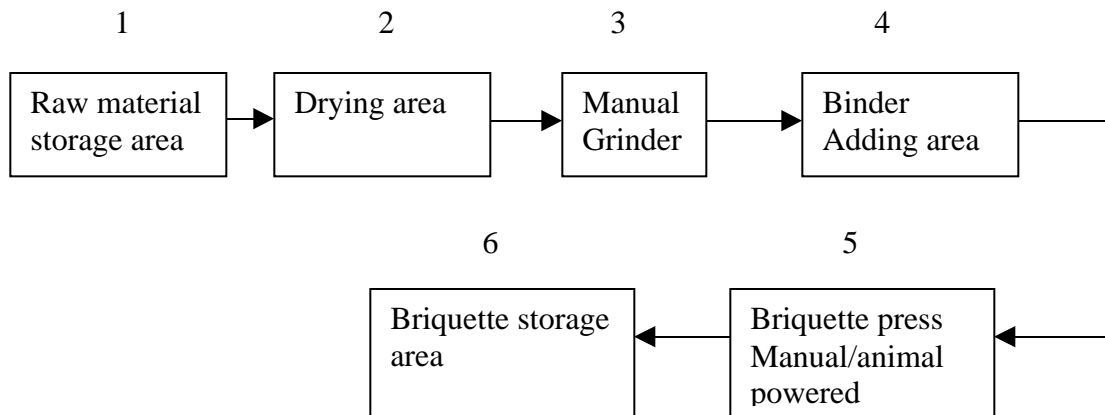
Briquettes: The utilization of agricultural waste is a good alternative in this connection and briquetting is a suitable process. Briquettes can be used for supplying energy for home use and for small urban industries. Briquetting process includes.



Animal manure which poses a serious health and environmental problem in urban areas is a very suitable binding agent. To increase the binding strength it could be combined with ash filter.

The encouragement of the use of briquettes would greatly reduce dependency on imported fuels and also help manage waste economically.

Steps in briquetting:



Many types of agro-wastes can be used for briquetting purpose if the above simple steps are followed. Vegetable waste can be used for briquetting but the moisture content must be reduced to 8-10% by drying.

CHAPTER - V

THE URBAN AND PERI URBAN FRUIT GROWER (HORTICULTURE)

There are fewer fruit trees in urban households now than a decade ago. The basic reason is the lack of space. Fruit trees are grown for the fruits and beautification. Many growers do not practice any management practice. Few who do, do it as a hobby. Simple timely operations can improve the health and production of fruit trees. A few appropriate operations which can have a significant impact on production is presented.

I. Prepare the planting place with care : Fruit trees are not like annual crops which can be harvested in a short period of time. Fruit trees live a long and productive life supplying nutritious fruits year after year to the grower. The grower must select the best location to plant his trees so that the trees can grow undisturbed. The fruit trees must not interfere with other requirements of the owner. Many times the trees are planted at the wrong place, which grows too close to the building, blocks the view from the window or sheds the leaves on the roof blocking the drains etc. A tree planted at the wrong place is a nuisance to the owner. The owner devises various means to try to “accommodate” the tree, disturbing its growth and production. Frequently adopted methods are heavy pruning, which can have a negative effect on the tree.

II. Many urban tree growers do not match the enthusiasm of getting a tree seedling with care in planting the seedling. It is very important for the urban farmer to start building up the survival capacity of the seedlings. This he can do by planting the seedlings in well prepared planting pits and filling the pits with healthy fertile soil. Many farmers dig any type of hole, push the roots into it, cover them up and let it go at that. The trees will remain and grow at the same place for many years, so it is wise to get the foundations right. For most seedlings a planting pit 4 feet in diameter and 3 feet deep would be ideal. Excellent growth has been obtained when the bottom of the pit is “broken up”. This results in good drainage. The growing roots do not encounter a hard impermeable layer. Drainage is very important during the early stages of seedling growth. Seedlings do not like too wet and watery surroundings.

III. Pruning : Mild pruning is better though some advocate severe pruning. The mild pruning will stop the amateur urban grower who often finds this part of the fruit-growing most difficult to understand. An urban fruit farmer must be made aware that trees are pruned to (a) to remove weak branches (b) to prevent over crowding of branches (c) to shape the trees not merely for appearance but to make its form the best possible for strength and for production and harvesting of the fruit.

IV. Irrigation : Fruit farmers have mentioned irrigation as one major demand to improve fruit production. This is too big a demand for us to fulfil. But, we will present some practical methods to “irrigate” the tree. The farmers in Kenya (Africa) have used partially buried flower pots or tin cans to utilize water efficiently. Bury an old flower pot with drainage hole (the flower pots available here have rather big holes, these need to be reduced by placing a stone/piece of wood) just beside the root zone, fill the pot with water and let the water flow into the soil slowly to wet the area. Mr. Gitonga, an innovative farmer in Kenya, has raised 25000 plants in his farm using this method. Dr. Carl Campbell at the University of Florida recommends that cans placed above ground can be better because then they can be shifted and moved to water more than one plant using the same can.

When these methods are used there is very little loss of water. Mr. Gitonga needed to water his trees only once a week using this method. He covered the top of his flower pot with a piece of wood to prevent evaporation. If we use a container with a narrow/small opening we can close it more easily. We would recommend Dr. Campbells method and suggest the can be placed at different places around the plants to get uniform root development. Plants show a tendency to grow more vigorous roots towards the source of moisture.

Mulching

To reduce surface evaporation, mulching is the most appropriate method. Many substances are recommended to be used for the mulch; Expert gardeners in UK and USA have recommended the use of well decomposed compost as one material because this material will absorb the rain, reduce soil evaporation, control soil temperature and

encourage earthworm activity. The use of fresh unrecompensed matter will reduce the soil evaporation but it will repel rain drops falling on it, and available soil nitrogen is utilized by micro-organisms to convert the fresh matter into humus.

The best time to apply the mulch is at the beginning of the dry season and it must be removed at the beginning of the rainy season. This however depends upon the climate of the location and weather of the season.

Insect Control : The control of insects on vegetables and crops using various biologically prepared sprays has been reported earlier. Some innovative methods for fruit tree insect control will be described.

- a. Farmers expressed difficulties in spraying fruit trees with the limited resources at their disposal. Farmers in China have successfully controlled insects on fruit trees using ants. They introduce ant nests on fruit trees and tie strings or thin bamboo poles from one tree to the other. Hungry ants devour young larvae present on the tree where they nest once the larvae are completely wiped out on this tree, they use the string or bamboo "bridge" to go to another tree in search of food. Ant nests placed at strategic locations and trees connected by bridges give good results.
- b. Birds are also used successfully to control insects from fruit trees in many parts of the world. Mr. E.R. Kalmbach of USDA in 1910 and 1911 observed that a pair of English sparrows collected as many as 1980 larvae per day (12 hours) and fed these to their young.

Wood peckers, sparrows, robins, starlings are all good enemies of insects with starlings particularly effective against gypsy moth. Nuthatchers and downy wood peckers are effective controllers of codling moth larvae. Birds are effective against locusts and other forms of grasshoppers as well.

- c. Bats and other nocturnal creatures are effective controllers of insects too. Many harmful caterpillars and grubs come out of their hiding places at night to feed. This is when they are devoured by these nocturnal predators.

Abusive use of insecticides and the destruction of their nesting places have wiped out large population of these useful creatures from urban areas. Conservation of useful predators must be a part of every urban agriculture development plan. Building nests, bird houses, providing feeding troughs with feed help increase bird population in urban areas. Holes and crevices, where birds used to nest in old type houses, are not present in modern buildings, therefore, nesting boxes placed at appropriate locations help attract birds to your property.

Fruit and Vegetable Preservation

A major problem faced by fruit farmers (specially those who have fairly large areas under fruit cultivation in peri urban areas) is the spoilage of ripe fruits which cannot be marketed in time. The ideal solution to this problem would be to be in contact with the many small industries who specialize in the manufacture of products by preserving and processing vegetables and fruits. We have published a list of these cottage industries in our urban agriculture directory. If the grower should fail to get any cooperation from this group here are some simple methods which can be used at home.

- A. **Drying** : This is the oldest method used to preserve food. The heat from the sun was used to dry fruits and vegetables and is still the most popular way. Dehydration to a desired moisture level improved storage quality and duration. Sundrying is wide spread in the tropic and sub tropic areas where there is plenty of sunshine. The equipment consists of drying trays, cutting knives etc. Fruits are cut or dried whole depending on the preference of the user or the demand of the customer. Drying trays or mats made from bamboo are used to dry the material. Wooden trays 90 cm long 60 cm wide and 5 cm high are good size trays for drying and handling. Most vegetables and fruits like apricots, bananas, dates, figs, grapes jack fruits, mango, peach, pear can be sun dried. Pomegranate seeds can be dried too. It is used in the preparation of tasty "Pachaks" which sell well.

i. Box type dryers

Which have the shape of small cabinets have been found to be very useful to dehydrate fruits and vegetables. It consists of a box of galvanized iron sheets 100 x 70 x 100 cm and is fixed on a wooden frame. Arrangements are made within the box to accommodate rows of trays with perforated bottoms. Articles to be dehydrated are placed on the trays which are heated using heaters. There are two openings on the top side of the box to allow moisture to escape. These openings can be opened or closed as desired. Seven trays 87 x 67 cm can be staked on support in a staggering position. Heat is obtained from a heat source (Charcoal, burner) placed at the bottom below an iron grate.

ii. The Solar Dryer

This solar dehydrator presented by ECHO is ideally suited to many small urban growers of vegetables and fruits. ECHO scientists are of the opinion that often the biggest challenge faced by a farmer is not in the production of the crop but rather in its preservation. Many small vegetable and fruit farmers in urban and peri-urban areas want to preserve their crop for future consumption or for sale at a time when the market will offer a higher price. ECHO recommend the use of a solar dehydrator. The dehydrator removes the moisture from food so that bacteria, yeast, mold cannot grow and spoil it. This design presented here was designed by Charlie Frost, ECHO's appropriate technologist.

Pretreatment: Pretreatment prevents the fruits from becoming dark. Many light coloured fruits such as apples, darken rapidly when cut and exposed to air. If not treated these fruits will continue to darken after they are dried. There are a number of ways in which pretreatment can be done. They are sulfuring, sulfite dip, Ascorbic acid, Fruit juice dip, Honey dip, Syrup bleaching, steam blanching. The following tables present drying fruits and vegetables at home.

Juice Pasteurizer :

This apparatus is useful in those areas where quantity of fruits are available for a limited period of time and for which there is no market or the price of the fruit is too low (like in many peri-urban farms). It is also useful in those areas where marketing is not easy because of lack of transportation. The local population could benefit financially or

nutritionally if an inexpensive pasteurized fruit juice could be produced. This technology was developed by Dr. Phil Crandall (in the late 1980s) at the university of Florida, USA.

The criteria used is the HTST principle which mean high temperature short time. This pasteurizer can be carried to the most remote parts by a single person.

Fresh citrus juice can be pasteurized when heated at 90°C (194°F) for a few seconds. This is achieved when the juice is passed through stainless steel pipe (Coil) immersed in a container of boiling water. Dr. Crandall bent a 6m (20 ft.) pipe into 9 coils 19 cm (7.5 in) in diameter by wrapping around an appropriate diameter cylinders (The cylinder could be a log). The inlet and outlet tubes were 30 cm over the sides. The coil was supported by a block of wood to prevent it from touching the bottom of the can. The length of time the juice is in the tube is controlled by the hydrostatic pressure. The higher the inlet funnel the swifter the flow of juice in the tube. Dr. Crandall's portable pasteurizer is shown. Dr. Crandall says the pasteurized juice can be stored without refrigeration for some months if kept in clean used brown beer bottles with a tight fitting.

Wood Ash as Tomato Preservator

Wood ash has been used to preserve harvested tomatoes for upto 3 months in the Philippines. Requirements:

- a. Newly picked tomatoes ripe but not soft and over ripe.
- b. Tomatoes must be free from disease, bruises, injuries and blemishes.
- c. Wooden, cardboard box or woven basket lined with paper.
- d. Cool ash from the cooking place (ash must be free from sharp particles).

Procedure to preserve

Spread the ash evenly on the box or basket floor. The ash must be 1.6" (4 cm) thick. Arrange the tomatoes (upside down) stem down) in one layer and pour another thin layer of ash on the tomatoes. Continue layering the tomatoes till the box is filled. Cover the top layer of tomato with ash and seal the container so that the ash and tomatoes are not disturbed. Store the box in a cool dry place. The skin of the tomatoes will wrinkle, but the pulp inside remains juicy. (Source: Amaranth to Zai Holes, an ECHO Publication)

By-Products from Fruits and Vegetables

These are some useful by-products from the fruit and vegetable farms which can be used locally to reduce wastage:

- I) Apple pomade left after the extraction of apple juice can be dried and used for the preparation of pectin
- II) Apple pomace can be used to prepare apple chutney like mango chutney.
- III) Apricot kernel can be used in confectionary like almond.
- IV) When grapes are used to produce juice and wine, stems and pomace are the main waste products, stems can yield cream tartar.
- V) Guava core with seeds and peel can be used to make guava cheese.
- VI) Siddappa and Bhatia found that the thick rind of Jack fruit with inner perigones are good raw material for high class jelly manufacture. Jack fruit "leather" like mango "leather" is made in homes in several parts of Kerala, India.
- VII) Mango peelings (20-30% of the fruit) is wasted. This can be extracted with water and fermented to get fruit vinegar. Mango peel juice can be fermented after concentration and used as molasses for cattle feed.
- VIII) The pear peel and core can be fermented into an alcoholic beverage called "perry" which can further be converted into fruit vinegar.
- IX) Pea vines and hulls can be dehydrated and used in animal feed.
- X) Tomato trimmings can be used to prepare juice, puree and ketchup of good quality.

Some Useful Tips for the Urban Cattle Farmers

The possibility of using animal manure as animal feed has been mentioned before. A major problem expressed by the urban, peri urban cattle farmer is the high cost of veterinary medicines. Some effective home remedies are presented.

- a. Poultry in tick control in cattle : The International Centre of Insect Physiology and Ecology in Nairobi, Kenya says that poultry might be able to play an important role in reducing tick populations. Engorged ticks generally drop from their hosts either late in the evening or early in the morning. If the infected cattle

- are stalled and poultry have access to the stalls, the birds would pick up the engorged insects.
- b. Marsha Hanzi mentions using guinea fowls instead of poultry for the same purpose.
 - c. One Homeopathic doctor in Brazil suggests adding a pinch of sulfur to the animals drinking water to increase the animals' resistance to the insect.

A note of caution on the use of poultry and guinea fowls for tick control, they love to feast on young vegetables and herbs too and scratch the soil. So be sure to keep them away from the garden.

The cattle and chicken must be "acquainted" to one other for effective tick control. The acquaintance can be induced by raising them together for some time and feeding birds with ticks as a starter.

Dewormer for goats : Ipil ipil seeds (50-100) are pounded into a paste form, mixed with 5-8 oz of water and given to goats as oral drench. The laxative effect kills or expels stomach worms.

Goats browsing on Melia azederach stems are healthy due to the deworming quality of the melia stem cover.

Dewormer for pigs : Worms in the pigs' stomach can be controlled by adding 5 ml cactus latex in the pig's diet. Care must be taken when the latex is handled because it can cause serious injury to the eyes even leading to blindness.

Detailed information on Ethno Veterinary Medicine in Asia is presented in the IIRR publication called Ethno veterinary Medicine in Asia: an information kit on traditional health care practices. To obtain a copy of this book be in touch with IIRR book Store, Philippines Email: iirr@phil.gn.apc.org

Animal Feed From Urban Waste

Domestic waste contains high percent (30-50%) of materials which can be used as animal feed. This is proved by the large number of animals seen eating in garbage heaps.

Substances which can be fed to the animals can be separated and grouped to be fed to the domestic animals at home or given to the neighbour who raises those animals.

A common system of milk distribution in many urban areas is that the dairyman brings the milk to the homes of the customer. After he delivers the milk, he goes away empty. He could be encouraged to carry the waste (animal feed) collected by the households. This system would benefit the milkman as well as the owner of the house.

Vegetable by-products (discards), fruit wastes, kitchen wastes are major constituents of the domestic wastes and they are all rich in nutrients. The amount of waste littering the city streets can be reduced considerably if the animal feed portion is removed and reused for home cattle or if it becomes a regular feature in the feeding of the neighbour's animal.

Waste from the vegetable/Fruit Markets

Some waste from vegetable markets are taken away by individual animal farmers to feed their animals. Hundreds of tons of this waste is still available to be reused. They can be converted to silage to prolong their keeping period and fed to the animals at the time of need. It will become difficult for the small urban farmer to undertake this activity. The municipal authorities can cooperate with private firms to start a vegetable waste silaging project and sell the nutritious feed to the urban animal farmer who has always faced the problem of feeding his animals.

In warmer urban areas, the waste can be used as fish food in fish ponds. Hundreds of tons of vegetable market waste is used to feed fish raised in the brackish waters in India and Bangladesh. Dried and powdered vegetable waste has been added in duck and poultry ration in many countries.

Waste from fruit markets can be used as feed for the animals too. Over ripe bananas have been fed to goats and pigs. Pine apple pulp has been fed to the animals directly. Mango waste has been used to make molasses which can be added to accelerate the fermentation process used for making animal feed or fish waste fertilizer.

Large amount of waste is generated daily in these markets so the authorities must initiate waste re-cycling projects with the involvement of the private sector. The final products can be sold to the interested groups in urban peri urban areas. The municipal

authorities can involve NGOs/INGOs to start a pilot project on vegetable and fruit market waste management.

A safer but more expensive and specific way of using urban waste for cattle feed is to grow algae, yeast, fungi, fly larvae and earthworms on the waste. All of these are potential protein source for ruminants.

Some Useful Tips for Mushroom Cultivators

Mushroom cultivation is gaining popularity amongst the urban and peri-urban households. Two popular types of mushrooms are cultivated at present and they are (a) *Agaricus bisporus* (Lange) Impeach called "Gobrey" in the local market (b) *Pleurotus sajur-caju* Calley "Kanya" in the local market.

Land becomes the limiting factor in most types of food production, but mushroom culture requires little room. It can become a good and profitable business in the urban area. With current technology high yields can be obtained with intensive stacked tray culture. Mushrooms are cultivated in composts, the yield is determined by the quality of the compost, the specie of mushroom cultivated, temperature, humidity and the hygiene. There are many types of composts prepared in various ways with different ingredients for the cultivation of button mushroom.

Synthetic Compost

The Indian Agricultural Research Institute (IARI) Method. Wheat straw (chopped) 1000 kg; wheat bran 80 kg; Urea 10 kg; calcium sulphate or calcium ammonium nitrate 10 kg, gypsum 40-50kg. Optional supplements; molasses 40 kg or 20 kg molasses + 20 kg cotton seed or groundnut + seed meal; chicken manure 100-150 kg. Molasses should be diluted 20 times with water. Poultry manure is added at the beginning of composting.

A major constraint expressed by many mushroom cultivators during interviews was the problem with post harvest and storage. Mushrooms are highly perishable therefore they have to be processed to prolong their shelf life – some common methods are:

- a. **Drying :** The Mushroom (button mushroom) can be dried to bring the moisture content to 12%. Drying for a few minutes at 60° C kills all insects infesting the mushroom. This dried mushroom can be kept in dry air tight containers for about

1 year. Blanching, that is immersion in boiling water for 3 minutes before drying further prolongs the quality of dried mushrooms. Dried mushrooms taste different from fresh ones. Some consumers may not like the taste. Dried mushrooms can be made into powder form and used in soups.

Other methods of preservation are cold storage/freezing, canning etc. They are expensive methods which need huge capital investment.

Honey Production

Honey was produced for home consumption in some urban homes in the past. One or two hives were kept and home produced honey was consumed regularly. Honey was also used in the form of medicine. Today, however honey production has been accepted as a good source of income. It is growing in popularity amongst the urban population. NGOs and INGOs have been running programmes with peri urban farmers and they provide subsidies to the poor to buy honey bees and hives. Honey bees collect nectar from flowers. The production of honey can be improved if the number of honey producing plants are increased in the urban and peri urban areas. Municipal and city development authorities could help in urban honey production if they include plants preferred by honey bees while growing trees for beautification of the cities. Honey produced in urban areas mostly come from flowers and trees in urban areas, not from crops which is the major source in agriculture farms. These are some important "honey" trees : (a) Humid Areas, (i) *Calliandra* (ii) *Gliricidia sepium* (iii) *Gmelia arborea* (iv) *Guazuma ulmifolia* (v) various fruit trees like mango, lichi, etc. (b) Tropical Highlands, (i) *Eucalyptus flabulus* (ii) *Grevillea robusta* (iii) *Inga vera*. These are exotic spp. Locally available species like China berry, Neem, bottle brush, various *Albizia spp.* *Bauhinia spp.* *Erythrina spp.* are all good species for honey bees.

Honey bees sometime become drunk and are a problem. Australian scientists studying bee keeping in Kenya noticed some bees behaving awkwardly. Drunk bees have difficulty in coordinating their actions and cannot return to their hives. Bees showing strange behaviour are not allowed to enter their hives by the guard bees. They are more easy prey to predators. The major cause for drunkenness is the weak sugar solution (which often ferments) fed to the hives during scarcity periods. Stronger sugar solutions

ferment slowly so are better than weak solutions as bee food given in the hives. The best step would be to finish the solution quickly before it has time to ferment. Many bee keepers do feed sugar syrup during marginal times. This brings into focus another reason colonies suffer either autumn collapse or spring decline in population.

Hive Protection : A mixture made from 1 oz melted paraffin was mixed thoroughly with 1 gallon turpentine oil or paint thinner. When 1.5 cups of boiled linseed oil is added to the mixture of wax + turpentine oil it gives a good wood preservative. This preservative when it is applied using a brush can preserve the wood which will be used for making the hives. Such hives have lasted for over ten years in Kenya.

Bee Control : Bee stings are very painful. It can be fatal if some one is bitten by a large number of bees. Bees though harmless most of the time can become extremely excited and aggressive sometimes. The best way to control swarms of aggressive bees is to spray soap water on them. Mix one cup detergent soap in one gallon of water and spray it on the bees. The detergent is a wetting agent so sticks to the bees. The bees are unable to fly with wet wings. This method can also be used when inactivating bees which have built hives in schools, in the crevices of buildings and in heavily used public buildings.

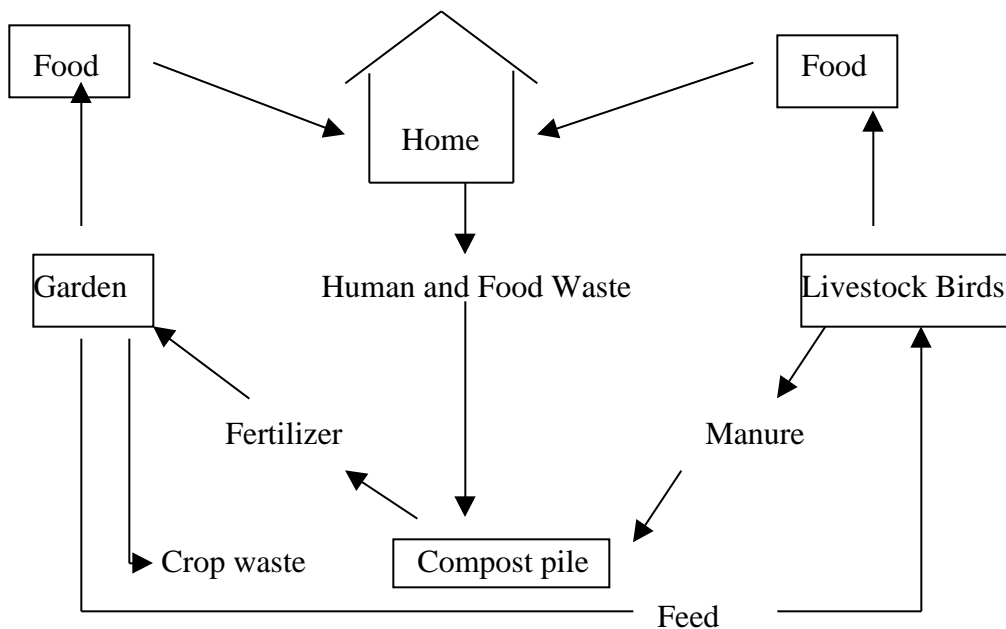
The value of the honey bee must not be confined to producing honey alone. Honey bees improve the production of many fruits by assisting in the pollination process. Bees also improve yields of many legumes and other crops. Some vegetables like carrots, radishes, turnips, cabbages, celery do not require pollination to produce an edible crop but they require pollination to produce seed and this is where the bee becomes an important ally of the farmer.

The government has established the Bee Development Section (BDS) under the Agriculture Department, Ministry of Agriculture and Cooperatives. BDS is the major government organization in Nepal which is involved in the promotion of bee keeping. There are a number of private organizations too who are active in extending bee keeping technologies to the public.

A. BENEFITS

Small urban gardens are the most appropriate and efficient economic units operating in the middle of the busy urban cities. These gardens with a large combination of trees, crops, vegetables and animals stimulate nutrient re-cycling and sustain diverse plant communities. These gardens establish a stable recycling system which is the result of the farmers choice of crops, trees, herbs, shrubs and vines. Weeds are kept to a minimum both due to the intensive nature of cultivation and the choice of crops in different seasons. Planting patterns also improve the synergistic relations between plant species. Farmers' experience and knowledge enable them to obtain maximum production from the small area because they usually manages the resources efficiently. The crop selection is geared to adopt to the micro-climate most efficiently.

The gardens are efficient centers for recycling wastes. They fertilize themselves through the steady incorporation of organic matter from the plants, the organic materials discarded in the course, the harvesting and processing activities going on in the house, the manure from domestic animals, sweepings from the kitchen. Animals and birds if present are important agents in the recycling process. Ducks, chicken, pigs scavenge for food yet provide high quality nutrition for households. Fish and bees if part of the system contribute to the well being of the family in their own way.



Possible integrated system (Source: Food, Fuel and Fertilizer from Organic Wastes)

Nutrition

The efficient cropping systems found in most UPA farms puts the potential for nutritional improvement within the means of many urban and peri urban poor. Urban plots with their vast combinations of crops and plants produce a number of products which contribute to the household nutrition needs. The fresh harvest retains most nutrients at the time of preparation unlike the products sold in the market which might have traveled some distance. The health of the urban poor would be far worse if they did not have wisdom and a small piece of land where they grow fresh food; raise some birds and keep some animals which contribute to satisfy their food needs and nutrient requirements.

Income

Urban and peri urban agriculture is the only source of income for a large number of urban inhabitants. Women and the aged who do not have any other income source are the major beneficiaries from this activity. Hundreds of such groups can be observed at all the crowded areas in the urban areas selling produce from their urban and peri urban plots. The majority of them sell garden products like vegetables, fruits and flowers while others sell milk eggs and birds. Few sell locally prepared food stuffs like pickles, fruit candies, sweet meats, flattened rice etc. The income derived from this sale is utilized to procure other non-farm necessities at home. It is also used for the education of the children and for medication when sick. These small scale growers are efficient managers of resources because they have to obtain a continuous supply of products from their land. In the valley, the urban small farmer grows rice for four to five months. He grows vegetables the rest of the time. The vegetable crops provide him with cash, food and financial security to some extent. Tirtha Bahadur Maharjan a sixty six year old farmer and Dil Maya his sixty year old wife said "We cannot imagine what would have happened to us if we did not have the small piece of land where we grow vegetables". They have been following the same routine for the past forty years.

CHAPTER - VI

Urban, Peri urban Agriculture in the Changing Urban Scenario:

(Direction for the Future)

The socio-economic conditions in UPA areas are changing rapidly. Effective planning, sincerity in implementation and adequate resources are essential to improve the productivity levels to feed the ever increasing population in these areas. Urban agriculture because it is such a new area for many development authorities (not to the practitioners) and because of its multi disciplinary nature need to be addressed accordingly. The correct choice of personnel and identification of training needs are the first steps to bring the desired change in urban and peri urban agriculture to meet new challenges.

At the national level : The government has a role to play to improve urban, peri urban institutional net work and personnel. Because of the bias towards rural agriculture the infrastructure has not been used to promote urban agriculture to their proper place of importance. The trained personnel have not focused their attention to urban agriculture development, Accurate information about UPA has never been collected. It has been difficult to base programmes due to the lack of vital information.

Ideally it would be wise for the government to initiate UPA development programmes, since this does not seem feasible under the government's present institutional sphere of responsibility and the personnel deputation framework it should be operated by any one who is familiar with the technical and social aspects of UPA. When an outsider is given the responsibility it may be difficult to get collaboration from the government institutions. This difficulty could however be overcome if the work is coordinated by an NGO with support from the local development authority (LDA). The local development authority can play the important role by encouraging different government agencies to meet and discuss the course of action to improve UPA. The programme leader will implement the direction given by the LDA and government staff. Number of NGOs could be involved to implement the programme who could be made responsible to the "guiding" committee composed of responsible government authorities, representative from UPA practitioners, the female elected member at the "Ward" level

and technically qualified scientists and researchers who have the expertise to help UPA practitioners in their localities.

In most under developed countries a cadre of NGOs is involved in research and action programmes from the national to the village level this group could be used effectively for UPA improvement. Many NGOs who were consulted showed eagerness and interest to work in UPA development.

At the peri urban areas: We have mentioned that there are established centers in peri urban areas which the government uses to promote various community development works. Existing institutions like schools, women development centers, health posts, the VDC office are appropriate institutions which can be involved in UPA development too.

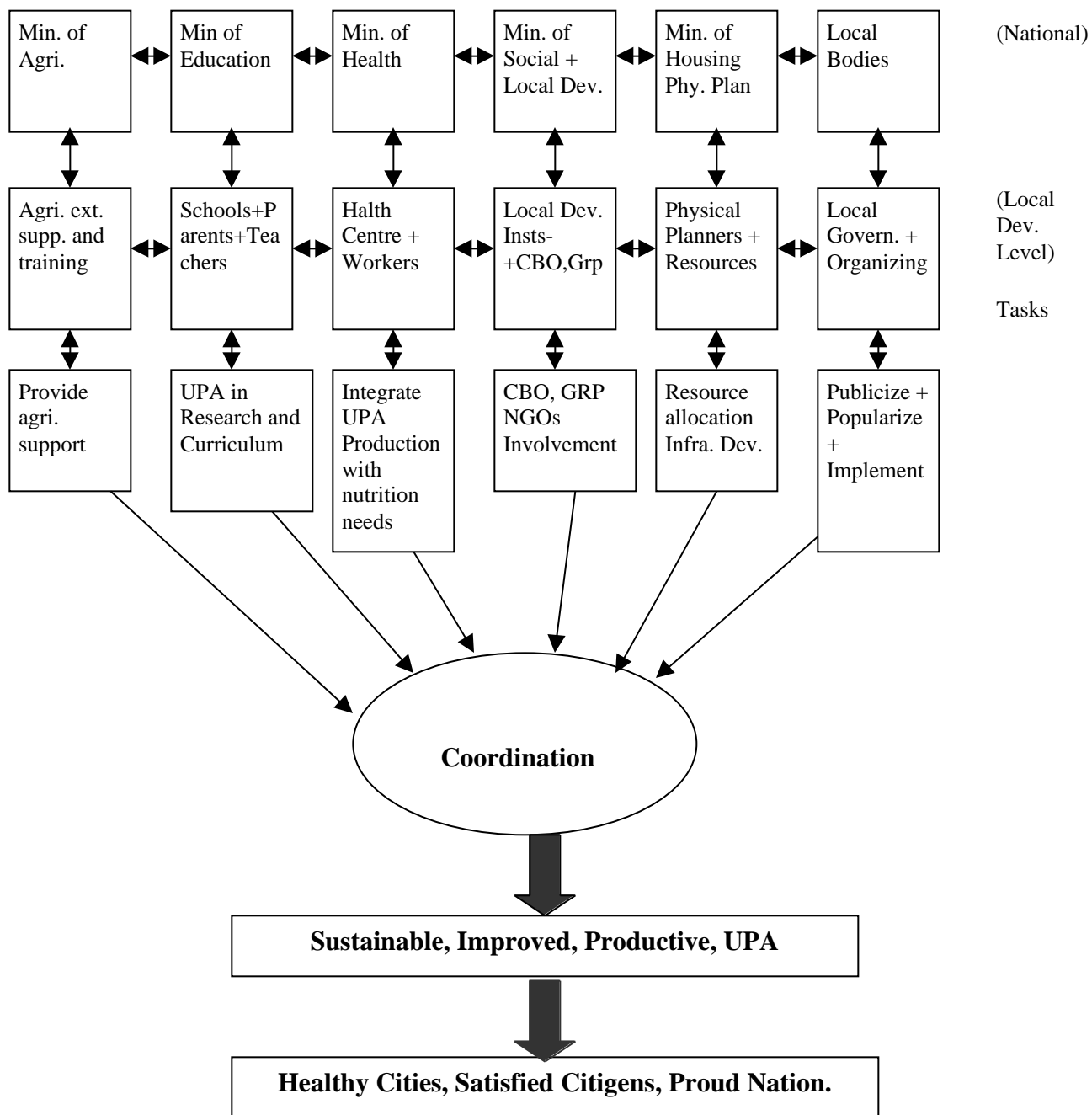
The government and donor agencies have various urban development programmes, so do UN agencies. The resources available with them could be used to support local organizations to help UPA.

The Universities with their educated human resources must be involved in UPA development. They have both human resources and expensive equipments which could be utilized to improve UPA.

Rural health centers, Mother and child care centers and trained man power available in these centers must be made aware about UPA. They could integrate production programmes with nutrition programmes for the benefit of the UPA families; and other urban groups.

Owners of banks and senior officers from financial institutions have always considered the urban agricultural producers as a sort of financial risk when investment plans are made for their institutions. These financial managers must be involved in the UPA development planning processes. Their bias opinions against UPA must be changed by presenting authentic UPA data to prove the importance of UPA in urban development. It must be proved to them that their institution will benefit by working closely with the large population who practice an efficient production system to feed the thousands in urban areas.

UPA Programme Routes and Results



CHAPTER - VII

Useful Information for the Urban/Peri urban Milkman

Frequent bunds, stoppages and strikes have affected the urban milk man seriously. Milk deteriorates very quickly if not handled properly. This results in loss to the producer and it affects the health of the consumer. Milk quality control in UPA areas are almost non existent in most developing countries. The methods common in advanced countries like sanitary production, farm refrigeration, refrigerated transport, and pasteurizing are impractical propositions for the poor urban milk producer who home delivers milk everyday personally. Sanitation is a universal problem because knowledge of cleanliness is often poor. The major problems faced to improve milk quality are lack of basic equipments, lack of clean and good quality water, heat, dust and slow transport in primitive carriers.

Poor quality housing for the milk animals is another cause of poor milk quality. Like in most developing countries, milk produced in UPA areas in Nepal are not subjected to quality tests frequently by the authorities. The authorities will not be in a position to undertake this task on a regular basis because of the lack of manpower, facilities and finance. Therefore the best chance to improve milk quality at present would be to create awareness amongst the producers themselves. There must be strict penalties and fines for those who deliberately adulterate milk for personal benefit at the expense of the health of the consumer. Some simple ways to reduce milk contamination and to maintain milk quality are.

- a. deliver the milk as quickly as possible to the customer because storing milk in the open for long spoils its quality.
- b. use clean utensils to milk and store milk.
- c. produce milk products (which store better under room temperature) like ghee, butter, cream, Khuwa, yogurt, curd if milk storage facilities do not exist. These products fetch a good price too.
- d. Clean the udders and milking hands properly before milking.

- e. If milk is boiled and consumed within 2-3 hours of milking then there is no need to test the milk for high standards.

In Costa Rica the government dairy paid the farmer according to the quality of milk he delivered. The better the quality and hygiene the more the payment. This method encouraged the farmers to produce milk of high quality. The quantity of substandard milk was reduced to 0.5% from 40% in 14 yrs. when this method was used. An urban milk producer can produce and market 'good' milk if he :

- a. makes sure that his animals are disease free and healthy by following the recommendation of the veterinary doctors.
- b. if he removes mud, manure from the udder and teats before milking
- c. if he cleans the flanks and tails because they can contaminate the milk in the pail.
- d. the milker must be disease free (specially infectious disease)
- e. the hands and clothes worn by the milker must be clean.
- f. the milkers hand must not be moistened by milk from the teats or the pail (common practice during hand milking)
- g. the milking pails must be thoroughly cleaned and sanitized.
- h. milk spoilage is minimum at or below 10°C so store milk in the coolest place, covered and away from any strong smell.
- i. never allow milk to get exposed to sunlight. Exposure to direct sunlight will make milk sour.
- j. The customer must make the milk man aware of the quality so that he works to produce clean and healthy milk.

The following table gives causes which 'spoil' milk and its simple solutions.

Major causes	Changes in milk flavour	Remeday
Microbial agents	Sour smell, acid taste, unclean appearance, bitter	cold/heat treatment clean handling. Sanitation clean water
Environmental affect	Smelly, weed flavoured, cow smell, barn smell, goat smell	Control feeding smelly grass, control feed handling, keep cows clean, control mixing of the cow with smelly animals.
Heat related	burnt smell, scorched, smell of burnt utensil	Care while boiling, use clean pots, heat control to prevent over heating
Contaminated with foreign matter	milk with 'outside' smell, like medicine smell, petrol smell, and salty taste	care while handling chemicals, medicines, and transportation/storage. When injected or vaccinated the medicine goes to the milk. A gap is needed to get pure milk.

Sometimes the milk loses its flavour and tastes stronger and fungi. Some of the causes and remedy are:

Flavour	Causes	Remedy
Sour, not fresh, over ripe smell	Poor cooling, dirty utensils or milking machines, dirty hands, mixing fresh and stale milk.	Keep the milk in cool place, cool it if possible. Clean the utensil and equipment. Do not mix stale and fresh milk. Deliver milk frequently when fresh.
Fermented, gassy, yeast flavoured, fruity flavoured	Poorly cleaned and dirty equipment, dirty barn and milking area, dirty teats and udder, poor ventilation, hot stuffy surrounding.	Clean the utensils properly. Keep the barn and milking area clean, keep the cows clean, have a well ventilated and cool cowshed.
Flavoured like a cheese 'cheesy'	Unclean utensils, milking pans and storage pans	keep the milk in clean sanitized pans. Use clean pots for milking.
Sour taste, spoilt taste rancid.	Dirty water, contaminated with micro organisms. Dirty and unclean equipments	Use clean safe water, and clean equipments and utensils clean milking hands.

A little care, cleanliness, promptness in delivery and attention on hygiene and sanitation at the milking and milk handling area saves the farmer a lot of trouble. He can escape the wrath of the customer too.

Appendix-1

Biological Plant Protection (Indigenous plant species Used for Crop Protection)

A. Repellants

Nepali Name	English name	Scientific name
Ajammari	Life plant	<i>Kalancho pinnata</i> Pers.
Lahasun (Lasun)	Garlic	<i>Alium sativum</i> L.
Aduwa	Ginger	<i>Zingiber officinale</i> Rosc.
Armale	Blue pimpermel	<i>Anagallis arvensis</i> L.
Ankuri	Flea killer	<i>Benninghausenia albiflora</i> (Hook)
Kukureghas	Toad stool	<i>Lippia nodiflora</i> (L) Rich.
Timmur	Nepal pepper (Pickly ash)	<i>Zanthoxylum armatum</i> DC
Titepati	Mug wort, Indian worm wood fleabare	<i>Artemesia indica</i> Wild
Tulsi	Holi basil	<i>Origanum majorana</i> L.
Thakal	Silvery Russian Thisle	<i>Crisium verutum</i> (D.Don) Spreng.
Thakjar		<i>Caesulia axillaries</i> Roxb.
Ghasingare		
Nal		
Neem	Neem	<i>Azadirachta indica</i> A.Juss
Pire		<i>Persicaria barbata</i> (L) Lam.
Bojho	Calamus root	<i>Acorus calamus</i> L.
Masala	Lemon sented encalyptus	<i>Eucalyptus citriodora</i> Hook.
Phelo Dudhe		
Mothe	Brown nut sedge	<i>Cyperus rotundus</i>
Rajbeli	Turk's turban	<i>Clerodendrum viscosum</i> Vent.
Lankasani	Four O'clock plant	<i>Mirabilis jalapa</i> L.
Sagaban	Teak	<i>Tectona grandis</i> L.
Sana sayapatri	Margold (small)	
Simali	Indian privet	<i>Vitex negundo</i> L.
Siltimmur		<i>Lindera nessiana</i> (Wall ex.Nees)
Bhang	Indian hemp	<i>Cannabis sativa</i> L.
Haledo (Besar)	Turmeric	<i>Curcuma angustifolia</i> Roxb.

B. Attractant (Traps)

Nepali Name	English name	Scientific name
Ajmoda	Garder celery	<i>Apium graveolens</i> L.
Alas	Linseed	<i>Linum usitatissimum</i> L.
Chitu		<i>Chlerodendrum viscosum</i> Vent.
Pamga	Sundew	<i>Drosera peltata</i> Smith
Badam	Peanut	<i>Arachis hypogaea</i> L.
Suryamukhi	Sunflower	<i>Helianthus annus</i> L.
Chinchine		<i>Crotalaria verrucosa</i> L.

C. Protectants (Shields) or Preventive

Nepali Name	English name	Scientific name
Aduwa	Ginger	G
Asuro	Malbar nut	<i>Justicia adhatoda</i> L
Aamp	Mango	<i>Mangifera indica</i> L.
Kapur	Camphor	<i>Cinnamomum camphora</i> (L.) J. Pres L.
Kathelahare	Nepal iny climber	<i>Hedera nepalensis</i> K. Koch.
Kusum	Safflower	<i>Carthamus tinctorius</i> L.
Keora	Screw pine	<i>Pandanus odoratissima</i> Roxb.
Khayar	Kutch	<i>Acacia catechu</i> (IL.f) Wild.
Chatiwan (Chabiban)	Dita bark	<i>Alstonia scholaris</i> (L) R.Br.
Thulo (Kuro	Pala indigo plant	<i>rightia arborea</i> (Dennst) Mabblerly
Nageswor	Ceylon iron wood	<i>Messua ferrera</i> L.
Parir pipala	Tulip tree	<i>Tespesia populnea</i> soland ex. Correa
Sati sal	Rose wood	<i>Dalbergia latifolia</i>
Sapota	Sapota	<i>Achras sapota</i> L.
Hallude	Wodier wood	<i>Lannea coromandilica</i> (Houtt) Merr.

D. Destroyers

Nepali Name	English name	Scientific name
Aduwa	Ginger	<i>Zingiber officinale</i> Rosc.
Asuro	Malabar nut	<i>Justicia adhatoda</i> L.
Anak	Giant milkweed	<i>Calotropis gigantea</i> (L) Dryland
Okhar	Walnut	<i>Juglans regia</i> L.
Kapur	Camphor	<i>Cinnamomum camphora</i> (L) J. Presl.
Karbir	Indian obander	<i>Nerium oleander</i> Blanco.
Karma	Yellow teak	<i>Adina cordifolia</i>
Kankro	Cucumber	<i>Cucumis sativus</i> L.
Khursani	Chilli	<i>Capsicum annum</i> L.
Kesour	Yambean	<i>Pachyrhizus erosus</i> (L) Urb.
Khamari	Malybush beech	<i>Gmelia arborea</i> Roxb.
Gandhe	Lizard tail	<i>Houttuynia cordata</i> Thunb.
Timur	Nepal pepper, prickly ash.	<i>Zanthoxylum armatum</i> DC
Tarul		<i>Dioscorea sagittata</i> Royle
Tite Karela	Bitter ground	<i>Momordica charantia</i> L.
Dron Puspa	Spider wort	<i>Leucas cephalotes</i> (Roth) Spreng
Dhaturo	Devil's apple	<i>Datura stramonium</i> L.
Neem	Neem	<i>Azadirachta indica</i> A. Juss
Nepali bix		<i>Campanula pallida</i> Wall.
Palas	Flame of the forest	<i>Butia monosperma</i> (Lam) Kuntze
Paris pipala	Tulip tree	<i>Thespesia populnea</i> soland ex Correa
Babari	Mint	<i>Mentha arvensis</i> L.
Beekh		<i>Aconitum chaomanthum</i>
Bojho	Calamus root	<i>Acorus calamus</i> L.
Marcha		<i>Senesio cappa</i> Buch. Han ex. D. Don
Ritha	Soap nul	<i>Sapindus mukorossi</i> Gaertn
Surti	Tobacco	<i>Nicotiana tabacum</i> L.

Source: National Agricultural Research Center, HMG, Nepal.

Appendix - 2

Rehydrating Dried Food

Product	Water to Add to 1 Cup Dried Food (Cups)	Minimum Soaking Time (Hours)
Apples	1_	_
Pears	1_	1_
Vegetables **		
Asparagus	2_	1_
Beans, lima	2_	1_
Beans, green snap	2_	1
Beets	2_	1_
Carrots	2_	1
Cabbage	3	1
Corn	2_	_
Okra	3	_
Onions	2	_
Peas	2_	_
Pumpkin	3	1
Squash	1_	1
Spinach	1	_
Sweet Potatoes	1_	_
Turnip Greens and other greens	1	_

* Fruits – Water is at room temperature.

** Vegetables – Boiling water used.

Drying Fruits at Home

			Pretreatment (Choose One)			
			Blanch			Drying Times
Fruit	Preparation	Sulfur (hours)	Steam (minutes)	Syrup (minutes)	Other	Dehydrat or *(hours)
Apples	Peel and core, cut into slices or rings about 1/8 inch thick	_	3-5 min. depending on texture	10	-ascorbic acid solution - ascorbic acid mixture - fruit juice dip -sulfite dip	6-12
Apricots	Pit and halve. May slice if desired	2	3-4	10	-ascorbic acid solution -asocorbic acid mixture - fruit juice dip	24-36**
Bananas	Use solid yellow or slightly brown-flecked bananas. Avoid bruised or overripe bananas. Peel and slice _ inch to 3/8 inch thick, crosswise or lengthwise.				-honey dip -ascorbic acid solution -ascorbic acid mixture - fruit juice dip -sulfite dip	8-10
Berries Firm:	Wash and drain berries with waxy coating (blueberries, cranberries, currants, gooseberries, huckleberries).				- plunge into boiling water 15-30 seconds to "check" skins. Stop cooking action by placing fruit in ice water Drin on paper towels. - No treatment necessary	24-36
Cherries	Stem, wash, drain and pit fully ripe cherries. Cut in half, chop, or leave whole			10 (for sour cherries)	-Whole: dip in boiling water 30 seconds or more to check skins. -Cut and pitted: no treatment necessary	24-36
Citrus peel	Peels of citron,				-No pretreatment	8-12

	grapefruit, kumquat, lime,lemon, tangelo, and tangerine can be dried. Thick-skinned navel orange peel dries better than thin-skinned Valencia peel. Wash thoroughly. Remove outer 1/6 to 1/8 inch of peel. Avoid white bitter pith.					
Figs	Select fully ripe fruit. Immature fruit may sour before drying. Wash or clean whole fruit with damp cloth. Leave small fruit whole, otherwise cut in half.	1 (whole)			-Whole: Dip in boiling water 30 seconds or more to check skins. Plunge in ice water to stop further cooking. Drain on paper towels.	6-12**
Grapes seedless:	Leave whole.				-Whole: Dip in boiling water 30 seconds or more to check skin. Plunge in ice water to stop further cooking. Drain on paper towels.	12-20
With Seeds	Cut in half and remove seeds				-Halves: No treatment necessary.	
Nectarines and Peaches	When sulfuring, pit and halve; if desired, remove skins. For steam and syrup blanching, leave whole, then pit and halve. May also be sliced or quartered.	2-3 (halves) 1 (slices)	8	10	-ascorbic acid solution -ascorbic acid mixture -fruit juice dip -sulfiting	36-49**

Pears	Cut in half and core. Peeling preferred. May also slice or quarter	5 (halves) 2(slices)	6 minutes (halves)	10	-ascorbic acid solution -ascorbic acid mixture -fruit juice dip sulfating	24-36**
Persimmons	Use firm fruit of long, soft varieties and rip fruit of round drier varieties. Peel and slice using stainless steel knife.				-may syrup blanch	12-15**
Pineapple	Use fully ripe, fresh pineapple. Wash, peel and remove thorny eyes. Slice lengthwise and remove core. Cut in 1/2 inch slices, crosswise.				No treatment necessary	24-36
Plums (Prunes)	Leave whole or if sulfuring, have the fruit	1			-dehydrator drying:rinse in hot tap water	24-36**

* Because of variations in air circulation, drying times could be up to twice as long.

Drying times for sun drying could range from 2 to 6 days, depending on temperature and humidity.

** Drying times are shorter for slices and other cuts of fruit.

Drying Vegetables at Home

Vegetable	Preparation	Steam (minutes)	Water (minutes)	Drying time
				Dehydrator *(Hours)
Artichokes-Globe	Cut hearts into 1/8 inch strips. Heat in boiling solution of _ cups water and 1 tablespoon lemon juice.		6-8	4-6
Asparagus	Wash thoroughly. Cut large tips in half.	4-5	3 _ -4 _	4-6
Beans, Green	Wash thoroughly. Cut in short pieces or lengthwise. (May freeze for 30 to 40 minutes after blanching for better texture.)	2-2 _	2	8-14
Beets	Cook as usual. Cool; peel. Cut into shoestring strips 1/8 inch thick.	Already cooked. No further blanching required.		10-12
Broccoli	Trim, cut as for serving. Wash thoroughly. Quarter stalks lengthwise.	3-3 _	2	12-15
Brussel sprouts	Cut in half lengthwise through stem.	6-7	4 _ - 5 _	12-18
Cabbage	Remove outer leaves; quarter and core. Cut into strips 1/8 inch thick.	2 _ -3**	1 _ -2	10-12
Carrots	Use only crisp, tender carrots. Wash thoroughly. Cut off roots and tops; preferably peel, cut in slices or strips 1/8 inch thick.	3-3 _	3 _	10-12
Cauliflower	Prepare as for serving.	4-5	3-4	12-15
Celery	Trim stalks. Wash stalks and leaves thoroughly. Slice stalks.	2	2	10-16
Corn, cut	Husk, trim and blanch until milk does not exude from kernel when cut. Cut the kernels from the cob after blanching.	2-2 _	1 _	6-10
Eggplant	Use the same directions as for summer squash.	3 _	3	12-14
Garlic	Peel and finely chop garlic bulbs. No other pretreatment is needed. Odor is pungent.	No blanching needed		6-8
Greens (chard, Kale, turnip, spinach)	Use only young tender leaves. Wash and trim very thoroughly.	2-2 _ **	1 _	8-10

Horseradish	Wash; remove small rootlets and stubs. Peel or scrape roots. Grate.	None		4-10
Mushrooms (WARNING, see footnote***)	Scrub thoroughly. Discard any tough, woody stalks. Cut tender stalks into short sections. Do not peel small mushrooms or "Buttons." Peel large mushrooms, slice.	None		8-10
Okra	Wash, trim, slice scrosswise in 1/8 to _ inch disks.	None		8-10
Onions	Wash, remove outer "paper shells." Remove tops and root ends, slice 1/8 inch thick.	None		3-9
Parsley	Wash thoroughly. Separate clusters. Discard long or tough stems.	None		1-2
Peas, Green	Shell	3	2	8-10
Peppers and Pimientos	Wash, stem, core. Remove "partitions." Cut into disks about by inch.	None		8-12
Potatoes	Wash, peel. Cut into shoestring strips _ inch thick, or cut in slices 1/8 inch thick.	608	5-6	8-12
Pumpkin and Hubbard squash	Cut or break into pieces. Remove seeds and cavity pulp. Cut into 1 inch wide strips. Peel rind. Cut strips crosswise into pieces about 1/8 inch thick.	2 _ -3	1	10-16
Squash: summer	Wash, trim, cut into _ inch slices.	2 _ -3	1 _	10-12
Tomatoes, for stewing	Steam or dip in boiling water to loosen skins. Chill in cold water. Peel. Cut into sections about _ inch wide, or slice. Cut small pear or plum tomatoes in half.	3	1	10-18

* Drying times could be up to twice as long, depending on air circulation.

** Steam until wilted.

*** **WARNING** : The toxins of poisonous varieties of mushrooms are not destroyed by drying or by cooking. Only an expert can differentiate between poisonous and edible varieties.