

Plantation Programme for Rich>Returns in Nepal

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Introduction

Nepal is comparatively a small Kingdom nestling luxuriously in the majestic lap of the Himalayas. It is located on a latitude of $26^{\circ} 22'$ to $30^{\circ} 27'$ north and its longitude is between $80^{\circ} 4'$ to $88^{\circ} 12'$ east. The East-West length of the country is 800Km parallel to the Himalayan Axis and the average north-south width is 140Km. Its total area is 147,181 Sq. Km. Its altitude varies from 60 to 220m in the south and rises to appalling heights of 8,848m in the north. Because of its topographic peculiarities, despite its relatively small size Nepal exhibits a very wide spectrum of geological, soil-compositional and climatological variations.

Temperature and Rainfall

The temperature in general tends to rise from east to west. For example, in June the temperature varies from 26° in the eastern Terai to about 32° in the western Terai. This variation in east-west temperature of this small Kingdom is due to two reasons: (1) the western part gets considerably less rain, from the sea and, (2) the hot winds, locally called *Loo* originating in the south-western desert areas engulfs the western part in hotter envelopes. In winter, series of cold gusts locally known as *Syanth* originating from the Himalayan Ranges penetrate downward causing sudden fall in temperature below the freezing point. At an elevation of 4880m the temperature conditions are as in cold deserts. The maximum temperature is -1°C and the minimum temperature is -18°C . However, the seasonal activities depend more on precipitation than on temperature. The pattern of rainfall in Nepal is similar to that of Northern India. Despite its small size, but due to its marked altitudinal-cum-topographic differences the distribution of rainfall is markedly uneven. The average precipitation in Nepal is 1015mm annually. Relief plays an important role in the rainfall distribution. Because of this the rainfall is heavy over the hills, north of plains, including the Mahabharat Lekh, and over the middle and further north to some extent around the zone of spurs and valleys. Further north, however, the rainfall decreases sharply. But most of the

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peaks of the Himalayan Ranges in Nepal stand higher than the level of monsoon activities. As a rule, therefore, the amount of rainfall on the average gradually decreases as one goes westward and increases as one goes up north from the plains but only to a certain level between 800m to 2000m. Above that altitude, whatever little rain there is, it is only due to the precipitation in the form of snow.

Location also plays an important part in rainfall catchment. Thus the windward side of the Mahabharat Range receives a lot more precipitation than does its other side. Again for example, though Kathmandu and Pokhara Valleys are topographically similar, the former gets only 1346mm of rains annually, whereas Pokhara gets 3810mm for the same period. Pokhara has an ensemble of big - deep - vast lakes in her lap which generate lot of moisture locally. Moreover, Pokhara is flanked by a strategically placed row of higher mountains, on the northern side of the Annapurna Himalayas, which force quick condensation of the moisture-laden winds.

The Rivers

In addition to the rainfall, this small Kingdom is blessed with benevolent River System. There are about 6000 rivers in Nepal, 1000 of which are more than 11Km long and about 100 of them are longer than 160Km. The total length of all streams and rivulets exceeds 45,000 Km. The " Drainage Density ", expressing closeness of spacing channels, is approximately 0.3Km per Sq. Km.

There are three grades of rivers in Nepal. The first grade rivers are the Karnali, the Narayani, and the Sapta Kosi. Along with their tributaries, they have their sources in the snow and the glaciers in the Himalayan region. The second grade rivers are the Bagmati, the Rapti, the Karnali, the Mechi, the Kankai, the Babai, etc. They originate in the Mahabharat Range, below the snowline. They are fed by the ground water including springs. Hence they donot dry up during low-flow period and as such are good for irrigation and hydropower purposes. The third grade rivers are the Tilawe, the Sirsia, the Manusmara, the Hardinath, the Sunsari, the Banganga, etc. They have their origins in the Siwalik (Chure or Churia) Range. These are unsuitable for irrigation and hydropower because of their very low water level and they dry-up during low flow season.

For hydrological purposes, the whole of Nepal has been divided into seven River Drainage Basins. The total annual run-off from the territory of Nepal is 4877CuM/sec which is equivalent of 153,800 million cubic meters or of 125.7 million acre-feet, whole of which, if distributed evenly over the whole country, is enough to cover whole of Nepal to a depth of 42.7 inches or 1086mm.

In addition to the bountiful amount of water for irrigation and hydropower of these River Systems, lakes, the Hot Springs are strewn over the length and breadth of the Kingdom. Last but not the least Ground Water Resources are as yet unscanned and mostly untapped.

The Static Water Level of the aquifers lie normally between 3 to 10m from the ground surface in the eastern and central Terai with yield between 100 to 300 Cum/hr under the drawdown of 7 to 15m. No plant, animal or human life can sustain for long without water. Undisputably, therefore, WATER is the most important of the natural resources.

Besides its life-sustaining gift of Water, its typical and characteristic meandering movements over mountains and dales and majestic "Falls" therefrom generate in water, the great *Potential for Power Generation*. On the basis of preliminary surveys for the three main out of the seven River Systems comprising of and encompassing 145500 Sq.Km.of area has *Hydropower Potential* of 83.28 million KW river-wise and 126.40 million KW basin-wise. Of the remaining River Stretches, the Technical Power Potential is 4534MW. The survey reveals that the theoretical Hydro-electric potential of Nepal's River System is around 83 million KW, which when compared to the World's potential of 5610 million KW comes to roughly 1.5 percent. Nepal's land area is only 0.11 percent of the world total. Thus the concentration of theoretical hydro-electric potential in Nepal is 13 times higher than that of the world average. This on the per capita basis comes out to be 48000 KWH. The studies further reveal that at least 50 percent of this is techno-economically feasible.

It is further claimed that even a single Mega Project can meet adequately the country's electric power needs upto the year 2000AD. But all this as of date remains just a theoretical possibility, and calls for huge investment, planning on long-term phased basis and last but not the least unflinching and untiring efforts at all levels of administrative and scholastic hierarchy in the country

Foreign collaboration in development activities must be welcome for a developing country like Nepal which is still on the lowest rungs of development ladder.

From the above very brief survey it is clear that despite being a small land-locked Kingdom, Nepal is bestowed by Nature with variegated wide-ranging geo-topographic soil, temperature, rainfall and surface and sub-soil abundance of water which apart from being useful for irrigation purpose has sufficiently adequate for the coming decades Hydro-electric power generation potential. Thus the Natural Infrastructural Scenario does exist in Nepal for sincerely experimenting on wide ranging unorthodox, nonconventional, innovative agricultural plantation practices which promise rich-returns. In the sequel an attempt has been made to streamline such plantation practices and suggest a strategy for the same.

Plantation Categorisation

For the purpose of evolving an Optimal Strategy in tune with the Nature's Benevolent Scenario depicted above, the plantation collectively will be categorised as follows:

Plenty in Natural Habitats: This category will include most of the forest products which grow on their own over vast stretches of areas. For them a package of appropriate technology will have to be developed that will include collection, storage, packaging, transportation and finally Marketing.

Better Varieties and Newer Strains: This category will include and involve lot of experimental research on better varieties and newer strains having rich-returns potential and which with marginal adjustment of cultivational practices and resonable amount of additional innovative inputs will take eventual roots and multiply rapidly in the natural soil and climatological conditions of specific regions in the country.

Marginal Products and By-Products: This category will include the naturally available products as well as certain by products which will be the outcome of processing of the above two categories. These will be collected and marketed only to fill in the gaps, as and when such gaps arise, in the entire operation of initial collection through the final marketing of the above two categories of products; so as to ensure optimal use of the technological complex developed for the strategy of plantation pattern for rich-returns.

The Rich>Returns Criterion

The returns will be the ratio of the "wholesale price" (WP) to the "cumulative cost", (CC) expressed for convenience and comparability as "percentage" of the latter. In symbols:

$$R = \frac{WP}{CC} \times 100$$

Since we are postulating large-scale plantation programme as also bulk supply at the wholesale terminals, wholesale price alone is deemed appropriate in the above concept of R, the "Returns". The cumulative cost will be inclusive of plantation, collection, storage (if necessary), marketing costs as also the normal profits of/for the programme so as to cover normal maintainance and wear and tear.

If the product is a known one, the wholesale price will be its international price and taken as datum. If the product is a new one and/or a speciality of this country, the WP will be determined in relation to the considerations of the CC and a reasonable level of R so as to justify its plantation programme.

Two Values of R will be useful for plantation planning:

- (a) $R_0 = 100$: This is the "break-even" value when $CC = WP$. This will lower value which will act as signal to continue the plantation programme and will generally refer to the the plantations listed above.
- (b) R_c : This is 'critical' or 'cut-off' value, which will be definitely above the R_0 value and will be dictated purely by commercial considerations and as such will have to be fixed in accordance with the normal commercial practices based on traders profit margins, risk coverage and the like.
- (c) All values above R_c will be deemed to be the rich-returns (RR) values which will justify continuance of the plantation programme of a specific item.
- (d) Further broad sub-divisions of RR values above the R_c may also, be made, if needed.

A Three-Pronged Plantation Strategy

On the basis of the above stated rich-returns (RR) criterion a Three-Pronged-Plantation-Strategy is suggested:

PS. 1: Survey of the existing plantation pattern, its regional and varietal distribution.

PS. 2: Identification of regions and varieties according to their categories listed above and labelling them as per their RR-values preparing socio-economic feasibility report on regions and varieties incorporating categorisation and RR-valuation.

PS. 3: Preparing a two-decade National Plantation Programme which will encompass, in addition to the above two-prongs establishment of regional research centers, plantation squads, nursing, preservation, procurement of products, proper storage, and last but not the least commercial packaging and marketing. This will also include publicity and propaganda on inculcating tastes and habits on the socio-economic uses of these products.

A brief Survey of existing plantation pattern, its regional and varietal distribution in Nepal as discussed in the introduction is really a nature's paradise.

The aerial photography of Nepal (1978) has revealed that of the total area, 22 percent is covered with forests and 78 percent cultivated land and bare mountains.

Total forest area is estimated to be 8.8 million acres (1972). Of this 3 million acres is "commercial forest".

Stainton (1972) has classified forests of Nepal according to regional distribution and varieties as follows: A: Tropical and Subtropical (10 Varieties); B: Temperate and Alpine Broad Leaved (11 Varieties); C: Temperate and Alpine Conifer (8 Varieties); D: Minor Temperate and Alpine Association (5 Varieties).

Forest products are fuel-wood, timber for building and construction, wild fruits and vegetables, flowers, decorative ferns, fibrous plants, mushrooms, weeds, medicinal/poisonous/religious plants.

Cultivated products include food crops (paddy, 61 percent; maize, 25 percent; wheat, 9 percent; millets, 4 percent; barley, 1 percent) and cash crops (sugar-cane: area A-24 Tha*, production P-483 TT**; jute: A-57 Tha, P-66TT; tobacco: A-8 Tha, P-6TT; potato: A-50 Tha, P-275TT; oil-seeds: A-112 Tha, P-77TT; tea: 5Tha, P-32T (1980-81).

Wild edible fruits have as many as 45 species belonging to 37 genera, which are surveyed to be found in Kathmandu Valley alone.

Fruits: The area under different fruits in Nepal is only 36,470 ha which comes out to be just 1.5 percent of the total cultivated area. The principal fruits grown in Nepal are apple, citrus, banana, guava, lichi, papaya and pineapple.

Medicinal Plants: Plants from Himalayan ranges have been used medicinally since

* Tha=Thousand Hectarea

** Thousand Tons

vedic times (*Rigveda* : 4500BC, *Ayurveda* a subsidiary Text of *Atharvaveda*:2500BC, *Samhitas*: 700BC) include *Charak*, *Susruta*, *Bhela*, *Kashyap*, *Harita Samhitas*; *Nighantu* of comparatively recent times have described over 290 herbal drugs. *Bir Nighantu* a hand-written encyclopaedia with 750 colour plates compiled in 8 volumes by Pt. Ghana Nath Devkota was completed in the beginning of the present century. Dr. S. B. Malla (Director General) and Dr. P. R. Shakya (Scientific Officer), Department of Medicinal Plants, HMG, Nepal have catalogued a total of 630 medicinal plants grown/found in Nepal.

Poisonous Plants: These have been broadly grouped into poisonous to man (25 species), poisonous to livestock (21 species), poisonous to fishes (9 species), poisonous to insects (6 species), poisonous to skin causing Dermatitis (3 species). Alternatively, they have been graded according to the intensity of their lethal effect.

Rhododendrons: There are as many as 500-600 species of this in the world. Most of them are distributed in the temperate northern hemisphere. The Himalayan belt harbours over 100 species. The Nepal section of this belt has 30 species whose number goes on decreasing as we move from east to west. The "Rhododendron Arboreum" specie locally known as *Lali Guras* has been designated as the national flower of Nepal. Even this national specie exhibits a great deal of variation in the colouring of its flowering and even of leaves. The colour changes from deep scarlet at lower elevations below 2000m to snow-white colour at altitude above 2500m, passing in the intermediate stages through various shades of pink, and going as high as 3500m. As the altitude increases, the height of the trees decreases from the highest 15m in the lower regions to a bare dwarfish height of the "Juniper" of just a couple of meters. These are seen even at altitudes of 4000m. The "Epiphytic" varieties grow in the form of thick carpets of moss that clothe tree-trunks and overhanging rocks. There are many uses: wood is mainly used as fuel, flowers of certain species are useful as incense, snuff, solvent for fish-bones, honey dew is sweet, whereas juice of some species is even poisonous.

Ferns: Mainly of botanical and decorative uses. In Nepal, there are believed to be as many as around 400 species of ferns. The works of Dr. R. R. Stewart and Dr. R. L. Fleming are important. The economic use of ferns as food-vegetable is quite prevalent in hilly regions where such species are known as "neuro".

Lichens: There are over 350 species of them in Nepal. Once regarded as useless, only recently its economic importance has been recognised. They are used for making spices and incense. Many contain volatile oils used in perfume industry. Some species have even medicinal properties and uses.

Orchids: There are over 17,000 species in the world. Nepal has over 90 genera and 310 species. They have their ornamental, medicinal and flavouring (e.g., vanilla) and dye-stuffs (e.g., indigo blue) as also their fibrous uses are yet untapped mostly.

Mushrooms: These are umbrella-type plants, some edible, most of them worthless, and a few even poisonous. There are over 3000 species all over the world. In Nepal alone there are over 107 species of edible mushrooms. Of the toxic variety there are not less than 40 species. At least seven of them are believed to be deadly.

Fibrous Plants: Depending on their use these have been grouped into five categories: textile fibre, brush and brooms, plaiting and rough weaving, filling and stuffing, miscellaneous. In these there are respectively 25, 11, 30, 8 and 24. Their common names are cotton, jute, hemp, mallow, nettle, grass, bamboo, palm, straw, moonj, etc.

Vegetables: There are over 100 species belonging to about 20 families, which are grown in Nepal. There are many heads and sub-heads: I. Fruit Vegetables- A Cucurbitaceous: cultivated (21), Wild (4); B. Solanaceous: cultivated (13), Wild (4); C. Leguminous: cultivated (10), Wild (3); D. general: cultivated (8), Wild (4). II. Flower Vegetables: cultivated (12), Wild (4). III. Herbage Vegetables: cultivated (23), Wild (21), IV. Shoot Vegetables: cultivated (7), Wild (5), V. Underground Vegetables: cultivated (17), Wild (7), VI. Seed Vegetables (8); VII. Microflora Vegetables: Algae and Fungi belong to this group, and VIII. Edible Mushrooms (11).

The above brief survey indicates and vindicates the truth that "Nature is beautiful and bountiful. Nature is variegated". And yet another appandage will be "Nature is wasteful too". Natural hazards in the form of pests, diseases are the natural concomitants of nature's scheme of plantation phenomenon. They pose great challenge to man's ingenuity and call for measures of preservation, protection, propagation of this plantation phenomenon.

A Plantation Programme for Nepal

Keeping in view the guiding line of the rich-returns criterion, on the very promising and potential natural scenario obtaining in Nepal, and on the threshold of the existing plantation pattern, an all-embracing and all-out comprehensive plantation programme is suggested below:

1. There is a need to set up a National and Regional Agronomical Botanical-Horticultural Research Institute with District-level branches acting as Two-Way Feed-Back Centres. The top of this three-tier set-up will mainly carry on research on newer items, varieties, species and strains and evaluate one's RR-Values in the context of regional climatological-altitudinal and soil conditions, etc. The regional level institutes will mainly be concerned with the operational activities and the district level units will be looking after the needs of the local agriculturists.

2. Newer and non-conventional items which *per se* have great prospects and potentialities in the context of a very wide spectrum of climatological-cum-soil-features obtaining in Nepal, a list of such items and species may be prepared and updated periodically. A tentative list would include plantations of (a) condiments and spices, black pepper, clove, cardamom, cinamom and other flavouring spices; (b) essential oils and perfumes, scents, incenses-tra-

ditional like *Itra* of rose, champa, kevra, mogra, jasmine, etc., (c) fruits and flowers : apples, (different varieties), apricots, grapes, gauvas mangoes, bananas, peaches, oranges; Cashew- wal and other nuts and other dry-fruits; roses, rhododendrons, lilies and tulips, etc; (d) fibrous plants of cotton, jute, silk (better varieties) and others including bamboo and palm; (e) timber and wood-better and fast growing varieties.

3. Plantation programmes at national, regional, district, village and domestic levels both on large commercial scale and for individual domestic consumption is needed. A national pass word may be—"Plant at least twenty saplings for each tree felled". Schools, Panchayats, offices, colleges and other institutions may be prompted to organise "annual plantation festivals and competitions". Prizes may be instituted for *highest survival ratios*. A three-year theme may be: "Keep Environment Growing and Green".

4. Plantation curricula may be prepared and manuals suitable for sub-regional specific conditions may be propagated through radio, television extension audio-visual aids.

5. Appraisal of the manpower needs of trained and competent personnel may be made for five, ten and twenty years planning perspective for the three-tier approach outlined above.