Horticulture Based Land Use Options for Resource Conservation, Market Needs and Mitigation of Climate Change

N.N.REDDY

Central Research Institute for Dryland Agriculture, Hyderabad - 500 059

Horticulture includes fruits, vegetables, root and tuber crops, mushrooms, floriculture, medicinal and aromatic plants, cashewnut, plantation crops including coconut and oil palm has established its credibility in the irrigated regions for improving productivity of land, generating employment, improving economic condition of the farmers and entrepreneurs, enhancing exports and providing nutritional security to the millions. However nearly two-third of horticultural commodities are raised from dry, arid and semiarid regions. A great of scope still exist in the development of dryland horticulture in India.

The Horticultural crops cover about 6.8% of the total area contributing 18% of grass agriculture output. Today India is the second largest producer of fruits (48mt) and vegetable (68 mt). Our share in the in world production is about 8% in fruits and 12% in vegetables. India produces 52% of world mangoes, 18% of the world bananas and 12% of the world onion. India is number one producer of mango and banana globally. We have achieved phenomenal growth rates in the production of apples, oranges, grapes, guava ,pomegranate etc. Even corporate sector is very much attracted towards fruit growing.

Soils:

In Andhra pradesh, North Telangana plateau has hot, moist semi-arid eco-sub region soilscapes having moderately to gently sloping Patancheru series of Udic Rhodustalfs and Kasireddipalli series of montmorillonitic. Typic Pellusterts, are the predominant red and black soils in the region. Kasireddipallli soils are the representative soils in Medak district. While Patancheru series are extensively found in parts of Medak and Ranga Reddy districts and the adjoing areas. The textures of Patancheru series vary from sandy loam to loamy sandy with heavy and compact sub soil horizon due to increased clay content and mild acidic nature. The problems are presence of gravel and high bulk density, poor moisture availability and frequent drought conditions .The soils of Kasireddipalli series are very deep, very dark grey strongly alkaline and calcareous with high and uniform clay content in the pedon. These are imperfectly drained, highly susceptible to erosion with high shrink –swell potential.

Physical and chemical properties of few representative soils

Depth (cm)	Clay%	pH(1:25)	EC(dsm-1)	OC(%)	$CaCO_3$(cmol(p+)Kg-1
Udic Rhodustalf (Patancheru Series)					
0-25.1.1	18.2	6.5	-	0.8	8.2
25-50	33.5	6.7	-	0.8	14.3
50-100	39.5	7.8	-	0.5	18.3
Typic Pellusterts (Kasireddypalli Series)					
0-25	53.7	8.8	0.1	2.0	0.7
25-50	58.4	9.4	0.1	9.5	0.5
50-100	67.4	9.4	0.4	20.0	0.3

Deccan plateau hot arid ecoregion comprises of mixed red and black soils. Red loams represented by Garnimitta series comprising Typic Rhodustalfs and the black soils are represented by Raichur series comprising Typic Pellusterts. They are highly susceptible to erosion and frequent drought. Sub soils is very hard when dry and acts as hard pan for root penetration and infiltration of water. Representative soils of Garnimitta sandy loams are slightly acidic to neutral with depth and clay content abruptly increases in the sub-surface layer. The Raichur soil series are very deep, dark Grey and moderately alkaline in soil reaction.

Selection of crops

The crops / varieties should be selected in such a way that they complete maximal growth during the period of moisture availability. Soil moisture stress is low from end of May onwards in the South and from July in the North. Fruits crops such as mango, lime, lemon, guava, pomegranate, aonla, jamun, wood apple, and tamarind may be grown in areas where the rainfall is more than 600mm. Fruits like custard apple, ber, phalsa, karonda, lasora, pilu and jamun may be grown in areas where the rainfall is less than 500mm. The crops may be selected which possess Xerophytic characters like summer dormancy (as in ber), deep root system (as in ber and mango), high bound water in the tissues (as in fig and cactus), leaf surface having sunken stomata, thick cuticle, wax coating and pubescence (as in ber, fig, phalsa, tamarind), reduced leaf area (as in aonla) and ability to adopt to shallow soils, rocky, gravelly and undulating waste lands (pomegranate, aonla, cashew, *Buchanania lauzan*).

In frequently drought prone areas, crops like ker (Capparis decidua), pilu (Salvadora oleoides) lasora or gonda (*Cordia myxa*), gondi (*Cordia gharaf*) and ber (*Zizyphus spp*.) can be taken up. Flowering and fruiting are synchronous to monsoon period in *Zizyphus spp*. Which is an added adoptive character in the dry arid regions.

In still drier areas crop species having maximal period of growth and fruiting during the period of maximum soil water and low atmospheric vapour pressure deficit, would be the most suitable ones. Such fruits can be cultivated under rainfed conditions using suitable water harvesting techniques eg *Carissa, carandas*, *C. grandiflora*, custard apple, pomegranate, guava etc.

Aonla is suitable for cultivation in saline / alkaline soils with some soil amendments. Fruit trees like aonla, seedling mango, tamarind can be grown even along the National Highways in high rainfall regions.

In dryland regions where the rainfall is between 300-500mm crops like cowpea, long melon, snap melon, kachri, okra, cluster bean, amaranth, bitter gourd, round gourd, sponge gourd, ridge gourd and bottle gourd can be taken. Almost all these vegetables can be taken if the monsoon starts early as per the regular schedule. If it is delayed till the middle of July or first week of August, choice has to be restricted to vegetables which mature in a short period. In still lesser rainfall areas (200-300) vegetables like snap melon, round gourd and kachri can be taken. In the region of less rainfall (<200) a watermelon cultivar Mateera can be grown on flat sandy soils with conserved moisture. In high rainfall areas all other vegetables can be grown in the drylands.

Vegetable based cropping system:

Since the vegetable crops vacate field early, small and marginal farmers can cultivate vegetables year round. Vegetables are short or medium duration in nature and can give a cropping intensity of 400%. Intercropping of vegetables even in field crops provide sustainability to the small and marginal farmers.

Suitable fruit and vegetable varieties for dryland regions

CROPS	**CULTIVARS**
FRUITS:	
Ber	Gola, Umran, Banarasi Karaka, Kaithli.
Pomegranate	Ganesh, Jyothi, P-26, Jalore seedless.
Mango	Banganapalli, Alampur Baneshan, Nelum, Mallika, Bombay Green, Amrapali, Kesar.
Sapota	Cricket Ball, Kalipatti.
Sweet orange	Mosambi, Kodur Sathgudi, Valencia, Blood Red ,Malta.
Lime	Tenali, Promalini, Vikram.
Custard apple	Bala Nagar, Arka Sahan.
Guava	Allahabad Safeda, Sardar, Arka Mridula.
Papaya	Coorg Honey Dew, Pusa Delicious, Pusa Majsty, Pusa Dwarf,Taiwan
Aonla	Kanchan, Krishna, Narendra –7.
Fig	Poona, Black Ischia.
Tamarind	PKM-1, Pratisthan, Yogeshwari.
Bael	Narendra Bael-5, Narendra Bael-9.
Passion fruit	Kaveri.
Radish	Arka Nishant.
VEGETABLES:	
Onion	Arka Niketan, Arka Kalyan, Pusa Red, Nasik Red, Pusa Ratnar, Pusa White Round, Pusa White Flat, Patna Red, Arka Pitambar (for export).
Tomato	Pusa Ruby, Pusa Early Dwarf, Swarna Mani,Vaishali,Naveen, Rupali, Rashmi
Brinjal	Arka Navneet, Pusa Purple Long, Pusa Purple Round, Pusa Kranthi, Arka Sheel, Arka Kusumakar, Arka Shirish, Swarna Shree, Swarna Manjari.
Chillies	G-5, G-3, Pusa Jwala, NP-46A, Arka Gaurav, Arka Lohit, Bharat, Sindhur.
Drumstick	PKM-1
Cowpea	Pusa Barsati, Pusa Rituraj, Pusa Dofasali
Cluster bean	Pusa Navbahar, Pusa Sadabahar.
Amarnath	Chhoti Chaulai, Badi Chauli.
Okra	Arka Anamika, Arka Abhay, Parbhani Kranti, Pusa Makhmali.
Water melon	Arka Manik, Arka Jyothi, Sugar Baby.
Musk melon	Pusa Sharbati, Hara Madhu, Punjab Sunheri, Pusa Maduras.
Bitter gourd	Arka Harit, Priya, Kalyanpur Sona.
Ridge gourd	Swarna Manjari, Pusa Nasdar.
Round melon	Arka Tinda.

Cabbage	Pusa Mukta, Pride of India, Golden Acre, Pusa Synthetic, Pusa Drumhead, Shree Ganesh Gol.
Cauliflower	Pusa Deepali, Improved Japanese, Pusa Snowball.
Pumpkin	Arka Chandan, Arka Suryamukhi

Export oriented vegetable farming

In addition to meeting the local demand, vegetables are now being considered as one of the potential commodities for export. APEDA has identified traditional vegetables like onion, bitter gourd and chilli; and non-traditional vegetables like asparagus, celery, sweet pepper, paprika, sweet corn, baby corn, green peas, french bean, cherry tomato and gherkins for good export earnings.

Onion accounts for 70% of total foreign exchange earnings among vegetables. Among others, okra accounts for 60%, green chillies for 20% and the remaining 20% include bitter gourd, french bean, capsicum. Among traditional vegetables- onion, okra, bitter gourd, green chillies etc. meet the requirement of South East Asia and Gulf countries and to some extent United Kingdom. Tomato products, especially puree and paste have great demand in export market.

With proper varieties, propagation methods, planting cum spacing methods, nutrient management, integrated insect pests disease management and water management including water harvesting usage of antitranspirants and mulches, the risks can be minimized in dryland horticultural crop production. Monocropping is often risk prone under dryland conditions. Profitable cropping systems involving horticultural crops can be taken up under dryland conditions.

Microcatchment or farm pond water harvesting system

Heavy rains resulting in the heavy down pours is not uncommon resulting in runoff even in dry land regions. About 15-30% runoff water could be capitalized for water harvesting and runoff recycling. Efficient utilization of harvesting water requires an elaborate consideration of selection of site, runoff inducement, storage, seepage, evaporation losses, water lifting and conveyance devices and their efficiencies. A farm pond of 150m^3 capacity with side slopes of 1.5:1 is considered sufficient for each hectare of catchments area in the black soils with a provision of emptying it to accommodate subsequent events of runoff.

Nutrition to the selected fruit crops (age wise in years)

Ia. Nutrient/tree (with SWC)	Mango			Ber			Pomegranate			Custard apple		
	1-2	5-7	> 10	1-2	5-7	> 10	1-2	5-7	> 10	1-2	5-7	> 10
FYM (kg)	20	40	75	10	20	30	5	10	20	10	20	30
N (g)	500	750	1000	150	500	625	125	150	300	100	200	325
P_2O_5(g)	250	500	750	100	250	300	100	150	300	75	150	250
K_2O (g)	500	750	1000	100	250	300	100	150	300	50	100	175
Zn SO_4 (g)	50	100	200	-	-	-	15	30	60	-	-	-
Ib. FYM (kg) with SWC	50	100	200	50	75	100	50	75	100	50	75	100
II. No SWC FYM (kg) (control)	20	40	75	10	20	30	5	10	20	10	20	30

SWC: Soil and Water Conservation

i) Mango-based agri-horti-pastural systems:

Table-1: Effect of different treatments on yield (t/ha) of 5-7 year-old mango orchards in the OFAR trials of Mahaboobnagar district of A.P.

Treatments	Years				Mean
	2001	2002	2003	2004	
I. With SWC measures					
RDF alone	2.43	2.32	2.86	3.87	2.87
FYM alone	0.92	1.72	2.83	3.75	2.30
RDF + Sorghum	1.31	1.85	2.88	3.95	2.50
RDF + Cowpea	2.28	1.92	3.00	4.23	2.86
RDF + Horsegram	1.92	1.75	2.92	4.67	2.81
RDF + Stylo santhes	2.36	2.22	2.83	4.18	2.90
RDF + Cenchrus	1.65	1.71	2.83	3.97	2.54
II. Farmer's practice without SWC & RDF	0.52	0.56	0.63	1.26	0.74

SEm±: 0.190, CD (0.05): 0.558, CD (0.01): 0.761 (For means).

RDF: Recommended Dose of Fertilizers.

Table-2: Effect of different treatments on yield (t/ha) of > ten year-old mango orchards in the OFAR trials of Mahaboobnagar district of A.P.

Treatments	Years				Mean
	2001	2002	2003	2004	
I. With SWC measures					
RDF alone	10.06	9.31	9.29	13.43	10.60
FYM alone	4.10	8.46	9.86	11.48	8.83
RDF + Sorghum	5.17	8.64	10.15	11.31	8.89
RDF + Cowpea	6.58	8.99	10.12	12.01	9.38
RDF + Horsegram	6.18	8.97	9.66	11.59	9.11
RDF + Stylo santhes	9.46	8.88	11.13	12.68	10.60
RDF + Cenchrus	5.32	8.80	11.43	11.49	9.19
Mean	6.70	8.86	10.23	11.99	9.51
II. Farmer's practice without S RDF	2.45	2.60	2.90	2.92	2.72

SEm±: 0.630, CD(0.05): 1.851,CD(0.01):2.523 (For means).

RDF: Recommended Dose of Fertilizers.