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New Models to Ensure Biodiversity Conservation in Agriculture In Puttalam and Anuradapura Districts

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GEF/UNDP Project "Enhancing Biodiversity Conservation and Sustenance of Ecosystems Services in Environmentally Sensitive Areas"

"Enhancing Biodiversity Conservation and Sustenance of Ecosystems Services in Environmentally Sensitive Areas" is a GEF funded project, implemented by the **Ministry of Mahaweli Development and Environment** (MoMDE) and supported by UNDP with the objective of streamlining biodiversity management in the course of development in the areas with conservation value." The project focuses integrating biodiversity conservation into the mix of diverse land use patterns in Environmentally Sensitive Areas (ESA) across Sri Lanka, especially in areas outside the Protected Areas.

ACRONYMS

ESA – Environment Sensitive Areas

DS – Divisional secretariat

GAP - GOOD AGRICULTURAL PRACTICES

G.C.E. - General Certificate of Examinations

PDOA – Provincial Department of Agriculture

DOA – Department of Agriculture

IPNS – Integrated Plant Nutrition Systems

IPM – Integrated Pest Management

OFC – Other Field Crops

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CHAPTER 1

Model development under incentive Based Biodiversity Mainstreaming in Agro Eco systems.

1.1-Back ground

Biodiversity in agriculture is to preserve lands, crops, animals while meeting the fast-growing demand for food and making it in more sustainable way. In both Anuradhapura and Puttalam districts use of excessive pesticides and chemical fertilizer is a grave problem. Damages to the forest for slash and burn agriculture, damages to marine resources, are continuing and there is a need to check this and introduce more biodiversity-friendly practices. In Puttalam district already groundwater is polluted with excessive fertilizer and agrochemicals causing a serious threat to the humans and animals. Damage to Kadolana (mangroves) is again a threat to the shrimps because mangroves are the breeding ground for shrimps.

Integration of biodiversity conservation into intersectional plans development and implementation of incentive-based mainstreaming of biodiversity conservation into agriculture, fisheries, and homestead management seems to be very vital and timely intervention.

Agro eco system will have various crop types and most of these crops are very important either for home consumption or for income generation. Paddy lands, fruit cultivations, small crop holdings or other field crops (pulses, sesame etc.), vegetable cultivations, crop plantations (major export crops), minor export crops, home gardens, including fruit cultivations in home gardens), chena lands (slash and burn cultivation) are the main crops cultivated in these two districts and when designing a biodiversity conservation program in agriculture these crops cannot be neglected. It is expected to improve biodiversity conservation in agricultural sector in these two districts by introducing some new innovations. Development of new agriculture related models to be tested in farmers' fields before recommending it to national level is one of the key suggestions in this project.

1.2-Necessity of incentive based model development.

Project activities will be carried out in Kala Oya Region (KOR) includes Kala Oya River basin and its surrounding area Within the Kala Oya Region; two sites have been identified as proposed ESAs. The first site – Kala wewa falls towards upper reaches of the river basin and encompasses a large water body (reservoir or tank) called Kala Wewa. The second site – Wilpattu is located in lower part of the basin and encompasses marine area including the Bar Reef and the estuary of the Kala Oya River. Agricultural biodiversity conservation activities will be carried out in Wanathawilluwa and

Karuwalagswewa D.S divisions in Puttalam district while in Anuradhapura district these activities will be continued in Palagala, Kekirawa, Galnawa and Ipalogama D.S divisions.

Under present agricultural practices not much attention has given to preserve agro biodiversity. Incorrect usage and application of higher doses of chemical fertilizers and pesticides has resulted serious problems to ground water quality, leading to numerous health hazards to humans and animals in the area. On the other hand climate change and water scarcity have restricted their income sources. Although In dry zone most of the farmers own large land extents due to this climatic problems they are unable to utilize their lands to get optimum results. Main focus of this project is to ensure biodiversity integration into slash and burn agriculture and homesteads of the two districts. In order to achieve this objective it is suggested to test some practical, effective, socially acceptable and economically viable new agricultural models into above mentioned areas. These models will be developed using existing climate, land use and cropping patterns in the area and exiting knowledge and experience of officers of department of agriculture is a key factor to be considered.

1.3-Key factors considered for designing models

1. Improvement to livelihood activities and more emphasis will be given to biodiversity conservation
2. Food security
3. Sustainable and regular income sources
4. Incorporation of underutilized crops to cropping patterns and linking production to the farmer's markets with GAP labels.
5. Water saving methods
6. Inclusion of Integrated Pest Control and GAP methods.
7. Encourage farmers to use only the recommended levels of fertilizer and pesticides.
8. Study of existing cropping pattern, rainfall and soil types, traditional cultivation methods.
9. Use the experience and knowledge of the departmental officers in the model development process.

1.4-Agro ecological zones and their characteristics in the project sites

District	D.S Division	Agro ecological Zone	Characteristics
Puttalam	**Karuwalagaswewa**	**DL1b and DL1f**	DL1b has reddish brown earth which is the major soil group. This area will get low rainfall during yala season and mostly will be dry from second week of May to end September. In DL1f area rainfall during Maha season is very low hence rain fed cultivation also is very uncertain.
	Wanathawilluwa	**DL3**	Major soil type in the area is Red Yellow Latasols but along the beaches/coastline Regasols can be

			found. This soils is porous in nature and due to limestone layer found in inside the soil water retention and availability is high. Area will get good rain fall from October to December thus have very short maha season. After December dry spell will prevail. This soil is ideal to cultivate under irrigation
Anuradapura	**Palagala,Galnawa,Kekirawa and Ipalogama**	**DL1b**	All four D.S divisions mostly consist of Reddish Brown earth and during yala season will get very low rain fall. Dry spell prevail from second week of May to end September

1.4.1-Agricultural seasons

- As mentioned earlier, Sri Lanka experiences rainfall from four rainfall seasons, namely First Inter Monsoon, Southwest Monsoon, Second Inter-Monsoon and Northeast Monsoon. For agricultural activities, these four seasons can be combined into two seasons, namely Yala and Maha. The Yala season is from March to September and includes the First Inter-Monsoon and Southwest Monsoon, while the Maha season is defined from October to February and includes the Second Inter-Monsoon and Northeast Monsoon

1.4.2- Rainfall pattern in the project area.

Inter monsoons, south -West and North East monsoons bring rains to the country.

1-First inter monsoon is from March to April

2-South-West monsoon from May-September

3-Second inter monsoon from October –November

4-North East monsoon –December-February

Both these districts will get substantial rainfall during North East monsoons but not from South West monsoons. Due to this reason Yala season cultivation is limited to certain crops unless supplementary irrigation is available. In Yala season usually from second week of May to end of September dry spell can be expected. When designing the models this important factor was taken into consideration and accordingly certain techniques will be adopted.

1.5-Present agricultural practices in two districts-

Recommended crops and cropping calendar of the Yala and Maha seasons for Wanathawilluwa, Kekirawa, Palagala, Ipalogama and Galnewa is shown in annex 1

It is obvious that if carefully planned diverse range of crops can be grown during the two seasons

1.6-Socio economic data in project sites

1.6.1-Literacy rate in the selected D.S divisions in Puttalama and Anuradhapura Districts.

Gender - wise literacy rate of the farmers in two D.S divisions in Puttalam District														
D.S division	Not attend to school		Attended to school up to grade 5		Attended to 6th to 10th grade		G.C.E (O/L)		G.C.E.(A/L)		Degree or above		Total	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Wanatawilluwa	90	31	648	224	1123	212	335	50	125	22	20	4	2341	543
Karuwalagaswewa	187	88	1549	571	2689	581	698	144	256	48	60	8	5349	1440

Source-Economic Census 2014 – Census and Statistic Department

In Wanatawilluwa D.S division 75% of the males have attended to school only till grade 10, while female percentage is 80%. In Karuwalagaswewa these percentages for males and females are 79% and 80 % respectively.

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Gender -wise literacy rate of the farmers in Four D.S Divisions in Anuradapura District														
D.S division	**Not attende to school**		**Attended to school up to grade 5**		**Attended to 6 to 10th grade**		**G.C.E (O.L)**		**G.C.E.(A/L)**		**Degree or above**		**Total**	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Kekirawa	160	110	1726	497	4632	825	1850	317	897	158	251	35	9516	1942
Ipalogama	148	83	1288	363	2493	469	1423	219	738	152	186	27	6276	1313
Galnewa	120	56	1728	433	3152	462	1295	235	532	97	113	17	6940	1300
Palagala	202	88	1765	431	2963	449	1519	258	681	106	119	18	7249	1350

Source-Economic Census2014 –Census and Statistic Department

1.6.2-Gender and age

Gender and Age wise farmers distribution in two D.S divisions in Puttalam District														
D.S division	**Age group 10-19 yrs**		**20-29 yrs**		**30-39 yrs**		**40-49 yrs**		**50-59 yrs**		**60 yrs and more**		**Total**	
	M	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**
Wanatawilluwa	**1**	**2**	**191**	**21**	**636**	**123**	**616**	**130**	**464**	**125**	**433**	**142**	**2341**	**543**
Karuwalagaswewa	**6**	**1**	**469**	**76**	**1491**	**237**	**1378**	**303**	**1161**	**388**	**934**	**435**	**5439**	**1440**

Source-Economic Census2014 –Census and Statistic Department

In Wanathawilluwa D.S division 91%of males who involve in agricultural activities are between 30 to 60 years while in females it is around 99%. In Karuwalgaswewa D.S division these percentages are again 91 % and 94%. This shows that younger generation is not willing to engage in agricultural activities. Youth involvement in agriculture seems to be very limited.

Gender and Age wise farmers distribution in four D.S Divisions in Anuradapura District														
D.S division	**Age group 10-19 yrs**		**20-29 yrs**		**30-39 yrs**		**40-49 yrs**		**50-59 yrs**		**60 yrs and more**		**Total**	
	M	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**
Kekirawa	**5**	**1**	**400**	**62**	**2152**	**238**	**2543**	**389**	**2417**	**561**	**1999**	**691**	**9516**	**1942**
Ipalogama	**4**	**1**	**261**	**37**	**1373**	**176**	**1808**	**283**	**1553**	**411**	**1277**	**405**	**6276**	**1313**
Galnewa	**3**	**-**	**281**	**62**	**1675**	**204**	**1925**	**296**	**1699**	**378**	**1357**	**360**	**6940**	**1300**
Palagala	**6**	**1**	**390**	**47**	**1621**	**181**	**1969**	**289**	**1775**	**387**	**1488**	**445**	**7249**	**1350**

Source-Economic Census2014 –Census and Statistic Department

1.6.3-Percentages of male and female farmers involved in agriculture and their literacy rates

D.S division	No of Males attended to school till grade 10	%	No of females attended to school till grade 10	%	No of Males in Agriculture in 30-60+ years age class	%	No of females in Agriculture in 30-60+ years age class	%
Kakirawa	6358	66.81	1322	68.07	9111	95.74	1879	96.75
Ipalogama	3781	60.24	832	63.36	6011	95.77	1275	97.10
Galnewa	4880	70.31	895	68.84	6656	95.90	1238	95.23
Palagala	4728	65.22	880	65.18	6853	94.53	1302	96.44

Chapter 2

2.1-Methodology adopted.

Climatic factors, soil types, rain fall patterns, present cultivation practices, income levels and threats to biodiversity in agriculture were critically considered and evaluated with two PDOA staff before designing these models. In the workshops it was stressed that any model that we are going to test in the field should be economically viable, socially acceptable and should be able to carry out without much hassle to the farmers.

2.2-Model development process

2.2.1 - Selection of beneficiaries

It is suggested to select beneficiaries using following criteria.

1. Beneficiary should establish the model in his own lands.
2. Should adhere to the DOA guidelines.
3. Maintain necessary records as stipulated in the model
4. After the first season should agree to maintain the same model with certain improvements if necessary for further three seasons.
5. Every endeavor should take to select widows, disabled persons, and poorest of the poor provided they can efficiently carry out the stipulated actions.

2.2.2 - Thumb rules considered

Following thumb rules were taken into consideration in the designing process of the models
(a) Multiple crops, annual and perennial crops, crops animal combinations
(b) Multi uses -some are only for shade, and green manure, erosion control, medicinal plants etc
(c) Soil stabilizers, microbiological developments,
(d) Mechanical conservation methods,
(e) Minimum use of artificial and harmful chemicals to any
(f) IPM, integrated management
(g) Forest trees, indigenous plans,
(h) All types of ecosystems within the main systems, ponds, big trees, fruit trees birds, reptiles and etc.
(i) No or minimum burning

2.2.3-Financial indicators based on gross margins

Developed all these models to include seasonal and perennial crops and animal husbandry activities .So, multi-year benefit cost assessment would have been more appropriate for such circumstances to determine financial sustainability of the proposed models. However, due to time constraint and simplicity of the assessment to be understood by the farming community only financial indicators based annual gross margins used .It is assumed to assure the financial sustainability. Those financial indicators easily understood and annual profitability is more appropriate to understand the adoptability of such models by the farmers.

Chapter 3

Model 1

Home garden development to conserve biodiversity (0.5 Acre)

3.1 - Proposed extent of the model-0.5 Ac-

Present home gardens are being done without paying much attention to above thumb rules. This new suggested model has most of the items mentioned under thumb rules and this will enable to improve biodiversity conservation as well as nutrition and food security.

3.2 - Labor requirement

–This model is designed to operate with family labor and thus recommended extent is 0.5 Ac.

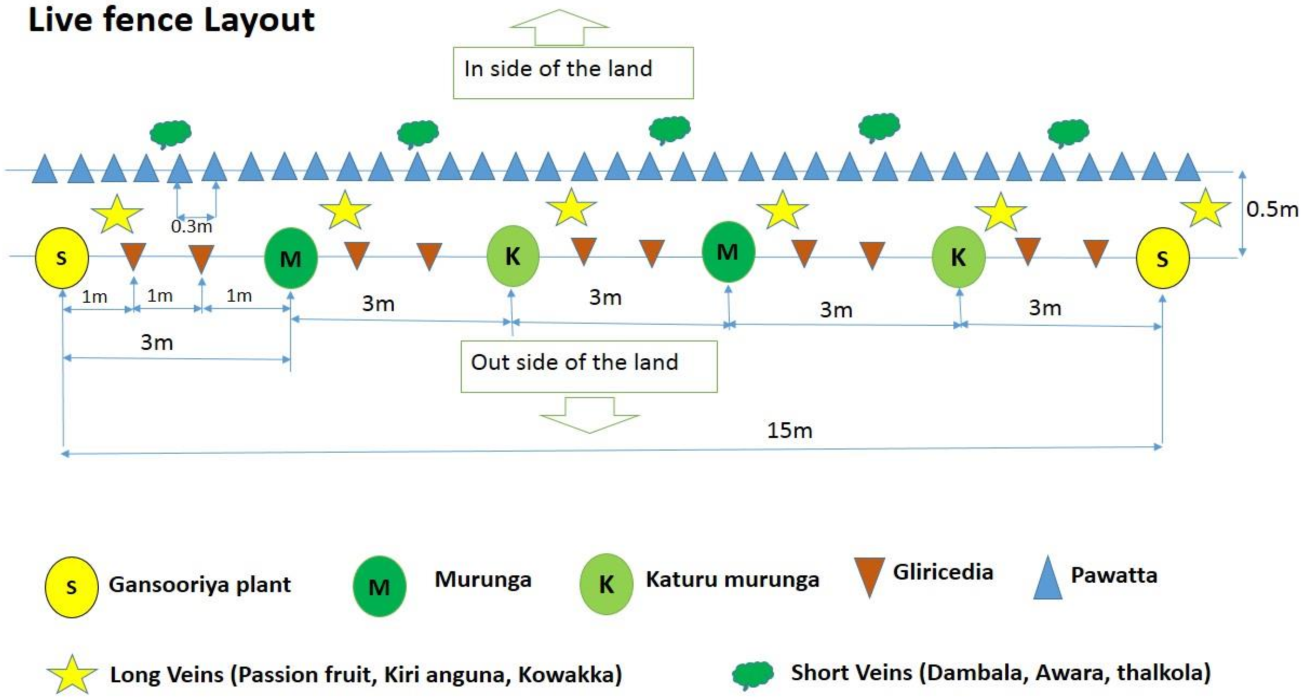
3.3 - Crop combinations, spacing, varieties and number of plants

- shown in the digital design. Main objective of this model is to improve present home garden concept to conserve biodiversity while ensuring additional income and food security. Model has developed for maximum utilization of the homestead. Approximate establishment cost of the Model – Rs. 247, 790-

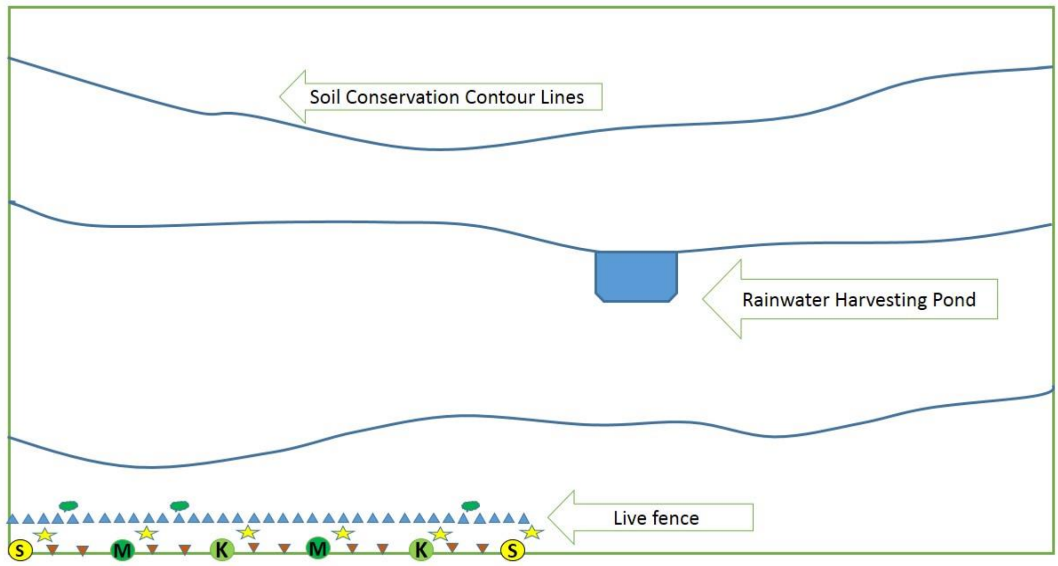
3.4 Various elements of the model and field lay out

- Live Fence
- Soil and Water Conservation
- Multiple Verities of fruit cultivation
    - Commercial orchard Cultivation
    - Underutilize Fruit Cultivation
- Medicinal Plant Cultivation
- Agro Forestry
- Home garden level Vegetable cultivation
- Animal Husbandry
- Compost, organic fertilizer & pesticide Production.

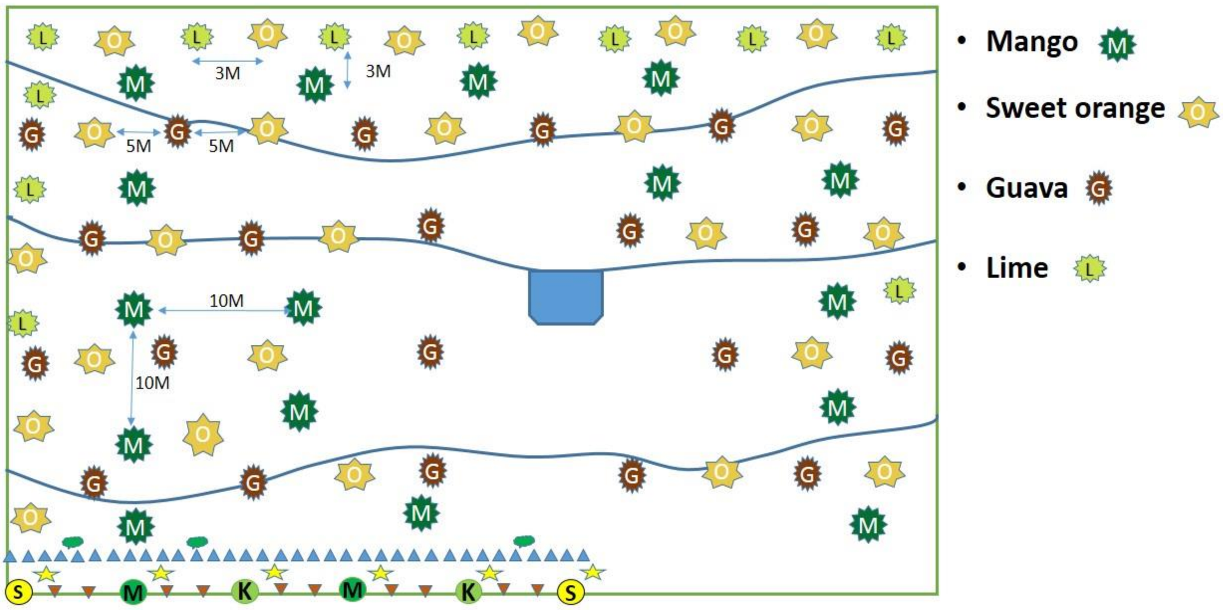
Live fence Layout



Soil conservation and Rain water harvesting Pond



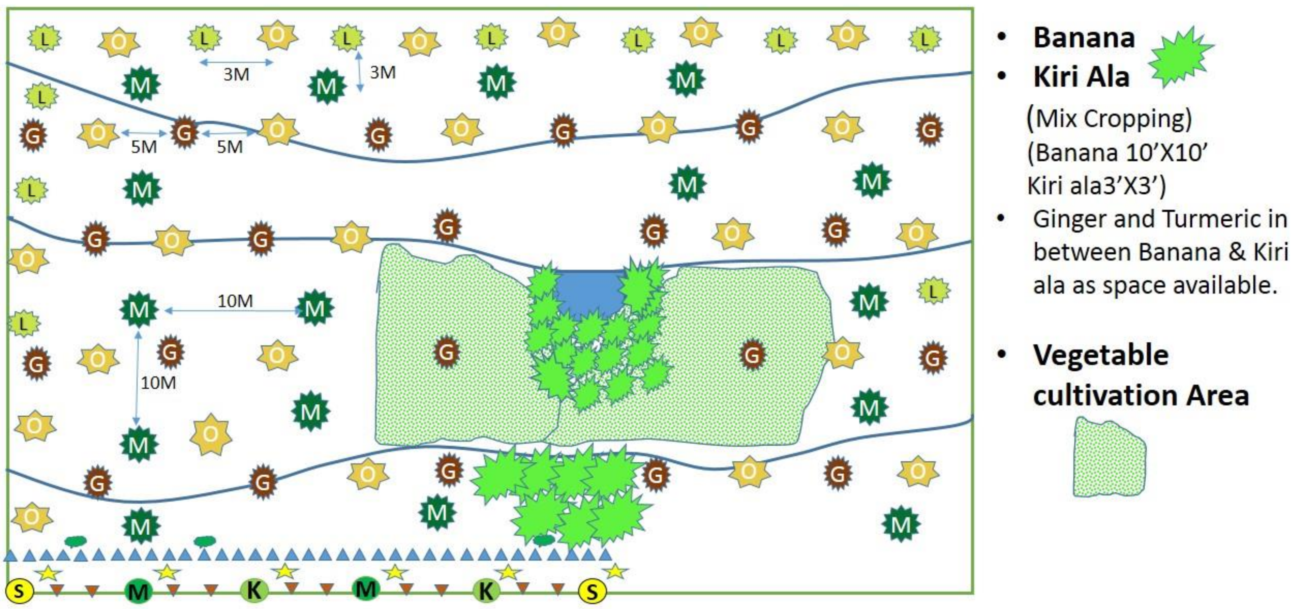
Commercial Orchard cultivation Layout – *Perennial, Wide and Medium Canopy*
(Mango, Sweet Orange, Guava)



Minimum Distance to cultivate Perennial crops.

- Mango – 10m X 10m
- Sweet orange – 10m X 10m
- Guava – 10m X 10m
- Mango – Sweet orange – Guava - 5m distance by each.

Vegetable Cultivation



Selection of Vegetables

Leguminacea crops

- Awara
- Winged Bean
- long Bean

Solanacea crops

- Chili
- Kochchi
- Capsicum
- Brinjol
- Elabatu
- Tibbatu
- Tomato

Cucurbitacea crops

- Bitter gourd
- Luffa (niyan watakolu)
- Snake gourd
- Pumpkin
- Cucumber
- Sweet melon
- Thumba karawila
- Kekiri
- Alu puhul
- Labu

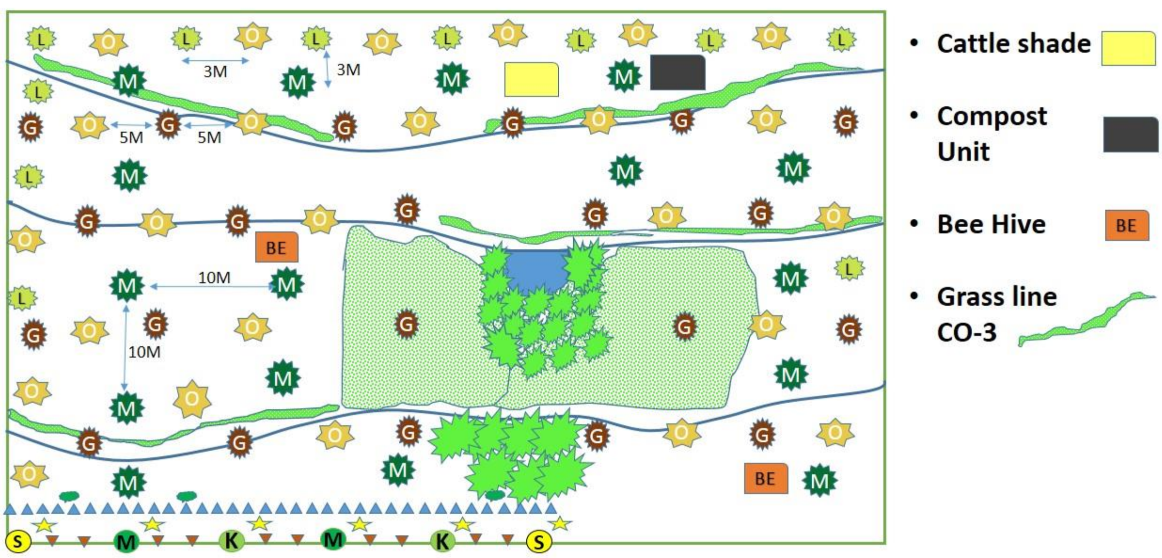
Yams

- Sweet Potato
- Manioc
- Raja ala
- Kiri ala
- Hulan keeiya ala
- Innala
- Kohila

Leaf Crops

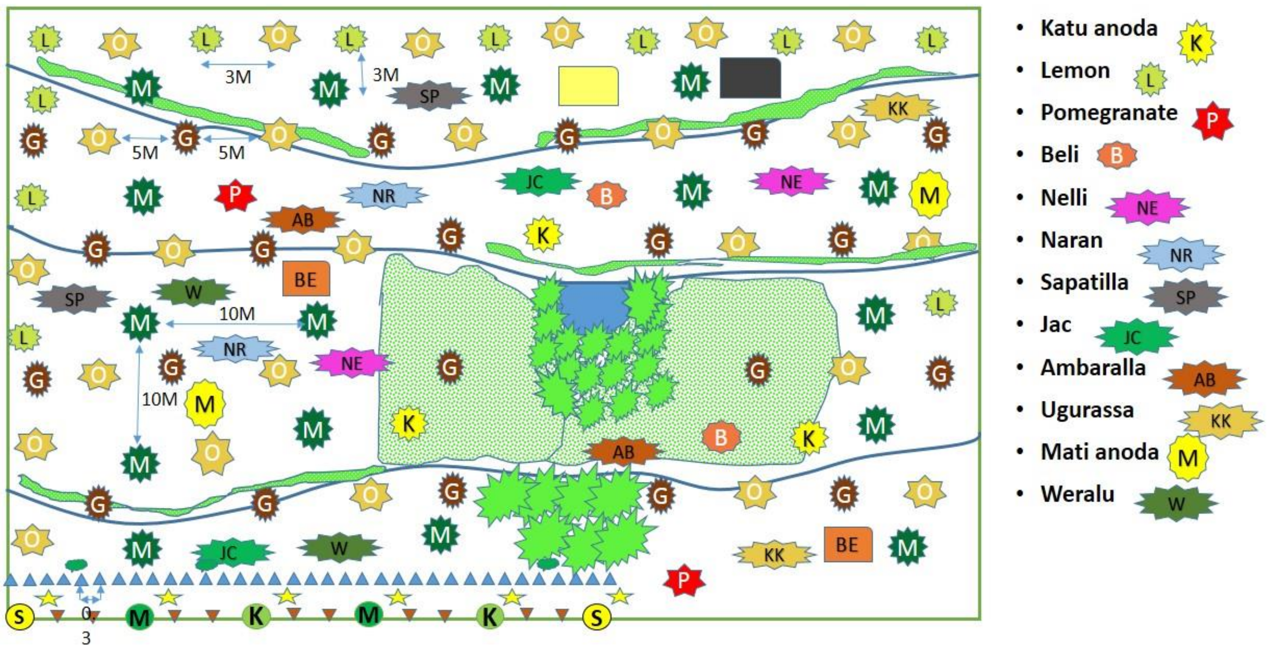
- Gotukola
- Mugunuwanna
- KanKun
- Tampala
- Saarana
- Kuura kola
- Kiri Angun.

Integrated Farming techniques.



- Animal husbandry unit (Cattle shed with 2 cows)
- Compost making Unit
- Bee Keeping (2 Bee boxes)
- Bio liquid fertilizer and Pesticide making Unit.

Fruit plant cultivation Layout - *Perennial Various Habit*



Underutilized Fruits

Beli
Nelli
Sapatilla
Ambaralla
Ugurassa
Mati anoda
Weralu
Mora
Kaamaranga
Katu Anoda
Jac

Medicinal Plants

Karapincha

Sera

Rampe

Suger cane

Ginger

Turmeric

Alovera

Sandal wood

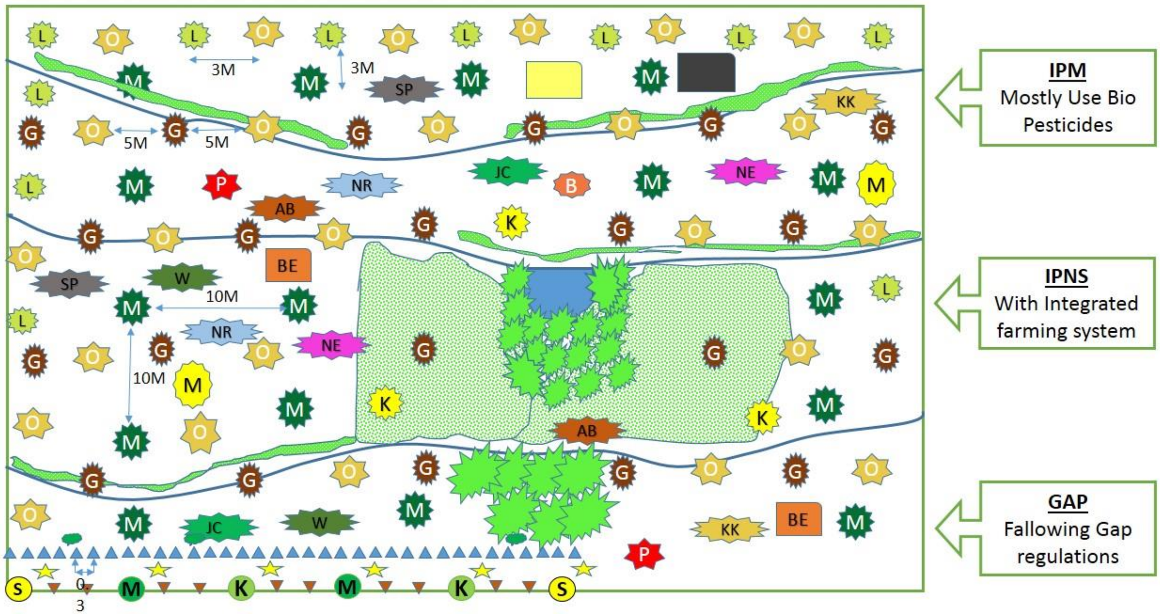
Forestry Plants

Neem

Satin

Ahala

Integration of GAP, IPNS & IPM



3.5-Assumptions and factors considered for this design

- **Banana –***Kolikuttu* is the selected variety. It has high market demand and can fetch a higher price.
  Each bush should be maintained with three plants and hope to get thee bunches per year. Banana will give shade to other crops such as *Kiri ala, Ginger and turmeric*.

- **Papaya –** Annual re-planting should be done to get continuous income.

- **Passion fruit –** Re- planting should be done once in four years. Vines are allowed to climb to live fence.

- **Mix Vegetables (home garden)** – It is expected to give most of the daily vegetable needs to the family. Excess can be sold at farmers market. This will help to improve family income and also to gain required nutrition. Additional benefit of home garden is to encourage unity of the family and mental satisfaction.

- **Dairy Unit** – It is expected to get a calf in each year .Milk consumption will improve family nutrition and excess milk can be sold. Selling of calves will bring additional income and dung can be used to make compost.

- All perennial fruit plants should be pruned well to avoid shading.

- All perennial fruit plants should be well pruned and maintained properly.

3.6-Estimate for the model-1

No	Crop	Unit	No of Unit	Unit Cost (Rs)	Total Cost (Rs)
1	Mango Tom EJC	Plant	10	250	2,500.00
2	Mango Karthacolomban	Plant	10	250	2,500.00
3	Orange Bibila	Plant	30	250	7,500.00
4	Guava Bangkok Giant	Plant	5	200	1,000.00
5	Lime	Plant	20	100	2,000.00
6	Pomegranate	Plant	10	70	700.00
7	Beli Budded	Plant	2	200	400.00
8	Safodilla Budded	Plant	2	200	400.00
9	Ambarella	Plant	2	200	400.00
10	Uguressa Budded	Plant	2	250	500.00
11	Nelli	Plant	2	70	140.00
12	Mora Budded	Plant	2	200	400.00
13	Mati Anoda	Plant	5	70	350.00
14	Katu Anoda	Plant	5	70	350.00
15	Banana Kolikuttu	Plant	50	150	7,500.00
16	Papaya Hybrid	Plant	20	50	1,000.00
17	Passion Fruit	Plant	20	50	1,000.00
18	Jac Budded	Plant	2	200	400.00
19	Vegetables*	1 Sq m	500	10	5,000.00
20	Thibbatu	plant	30	40	1,200.00
21	Mix Vegetables	1 Sq m	1	50	50.00
22	Kiri Ala	plant	150	20	3,000.00
23	Bees Honey per Box	Hives	2	1500	3,000.00
24	Dairy Unit - Milk - one cow	Unit	1	50000	50,000.00
25	Murunga	Plant	30	10	300.00
26	Coconut	Plant	3	200	600.00
27	Thumba Karawila	Plant	50	50	2,500.00
28	Live fence	meter	180	100	18,000.00

29	Rain water Harvesting Tank(200 Cubic meter)	unit	1	50000	50,000.00
30	Soil Conservation Bunds(M)	meter	150	100	15,000.00
31	Plastic tank (1000L)	unit	1	15000	15,000.00
32	Alkhathine tubes (0.5 inch) M	meter	200	30	6,000.00
33	Drippers (online adjustable)	Nos	100	20	2,000.00
34	Barrel for organic liquid fertilizer (200L)	Nos	2	2000	4,000.00
35	Rigiform Box (18"X24")	Nos	10	500	5,000.00
36	4" Plastic Dip cup	Nos	60	25	1,500.00
37	Albert Solution mixture	Kg	2	500	1,000.00
38	Labor Charges	Man date	20	1500	30,000.00
	Total Cost				**242,190.00**

3.7-Potential income

	Crop	For 3yrs	For 5yrs	For 7yrs	For 10yrs
1	Mango (Tom EJC)	5,000	69,375	206,875	431,875
2	Mango (Kartha Colomban)	0	7,500	59,250	160,500
3	Orange(Bibila Sweet)	0	19,500	72,000	162,000
4	Guava (Bangkok Giant)	52,500	214,500	394,500	664,500
5	Lime	0	14,000	74,000	164,000
6	Pomogranate	1,000	16,250	34,250	61,250
7	Ambarella	0	0	720	4,470
8	Underutilize fruits	0	2,000	6,000	12,000
9	Katu Anoda	1,700	3,700	5,700	8,700
10	Banana Kolikuttu	240,000	540,000	840,000	1,290,000
11	Papaya Hybrid	75,000	153,750	232,500	350,625
12	Passion Fruit	8,000	15,500	23,000	34,250
13	Thibbatu	34,000	66,000	98,000	146,000
14	Mix Vegetables (Home garden)	180,000	300,000	420,000	600,000
15	Kiri Ala	22,500	37,500	52,500	75,000
16	Bees Honey per Box	12,000	21,600	31,200	45,600
17	Dairy Unit - Milk - one cow	56,700	170,100	283,500	397,275
18	Pineapple	12,500	22,500	32,500	42,600
19	Murunga	18,000	42,000	66,000	102,000
20	Coconut	0	0	12,000	48,000
21	Elabatu	600	1,000	1,000	1,000
22	Thumba Karawila	15,000	25,000	35,000	50,000
23	Karapincha	1,500	2,500	3,500	5,000
24	Pumpking	6,000	10,000	14,000	20,000
25	Kekiri	1,350	2,250	3,150	7,050
26	Ash Pumking	600	1,800	2,200	2,800
27	Cucumber	900	1,500	2,100	3,000
28	Sweet Melon	900	1,500	2,100	3,000
29	Gliricidia	3,600	6,800	10,000	14,800
30	Pawatta(Per meter)	19,800	41,400	63,000	95,400
	Total-Rs	769,150	1,809,525	3,080,545	5,002,695

3.8-Finacial indicators based on gross margins.-10 yrs

MODEL 1	year 1	year 2	year 3	year 4	year 5	year 6	year 7	year 8	year 9	year 10
Income	82,600	248,375	405,025	475,075	533,200	595,745	643,975	583,400	644,625	644,625
Cost	392,790	180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000
Profit	**- 310,190**	**68,375**	**225,025**	**295,075**	**353,200**	**415,745**	**463,975**	**403,400**	**464,625**	**464,625**
Income/cost Ratio	0.21	1.38	2.25	2.64	2.96	3.31	3.58	3.24	3.58	3.58
Income/cost %	21.03	137.99	225.01	263.93	296.22	330.97	357.76	324.11	358.13	358.13
Profit/Cost Ratio	-0.79	0.38	1.25	1.64	1.96	2.31	2.58	2.24	2.58	2.58
Profit/Cost %	-78.97	37.99	125.01	163.93	196.22	230.97	257.76	224.11	258.13	258.13

Cumulative Income	82,600	330,975	736,000	1,211,075	1,744,275	2,340,020	2,983,995	3,567,395	4,212,020	4,856,645
Cumulative Cost	392,790	572,790	752,790	932,790	1,112,790	1,292,790	1,472,790	1,652,790	1,832,790	2,012,790
Cumulative profit	- 310,190	-241,815	-16,790	278,285	631,485	1,047,230	1,511,205	1,914,605	2,379,230	2,843,855

Income/cost Ratio	0.21	0.58	0.98	1.30	1.57	1.81	2.03	2.16	2.30	2.41
Income/cost %	21.03	57.78	97.77	129.83	156.75	181.01	202.61	215.84	229.81	241.29
Profit/Cost Ratio	-0.79	-0.42	-0.02	0.30	0.57	0.81	1.03	1.16	1.30	1.41
Profit/Cost %	-78.97	-42.22	-2.23	29.83	56.75	81.01	102.61	115.84	129.81	141.29

Model 2

Mango Cultivation with improved biodiversity conservation and good agricultural practices (1 Acre)

3.2.1-Proposed extent of the model-1 Ac-

At present mostly mango is cultivated as a mono crop but giving wider spacing will help to do inter cropping .As a main crop mango will be produced using god Agricultural practices and produce is expected to link to farmers market.

3.2.2-Labor requirement -family and hired labor.

3.2.3- Crop combinations, spacing, varieties and number of plants

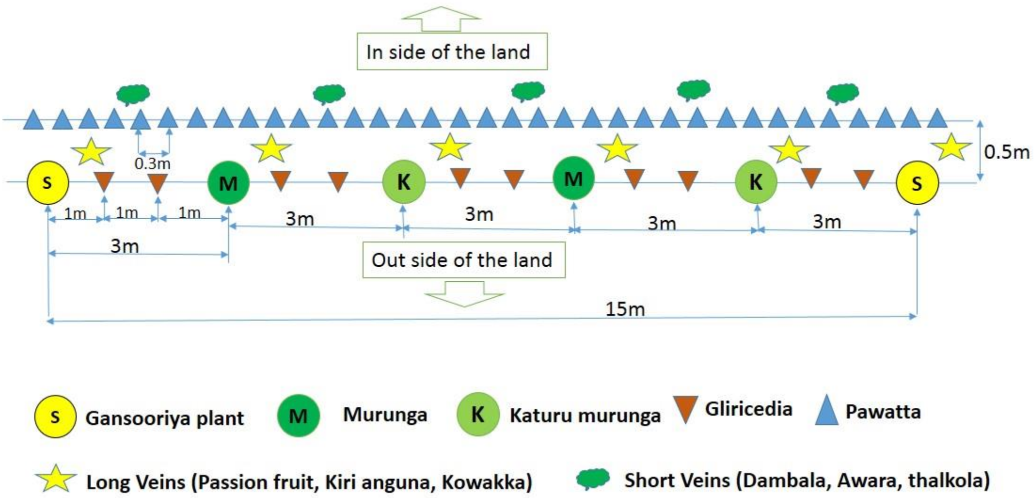
Are shown in the digital design .Main objective of this model is to improve present mango cultivations to conserve biodiversity while ensuring additional income and food security. Model has developed for maximum utilization of the land to include number of other crops.

3.2.4-Various elements of the model and field lay out

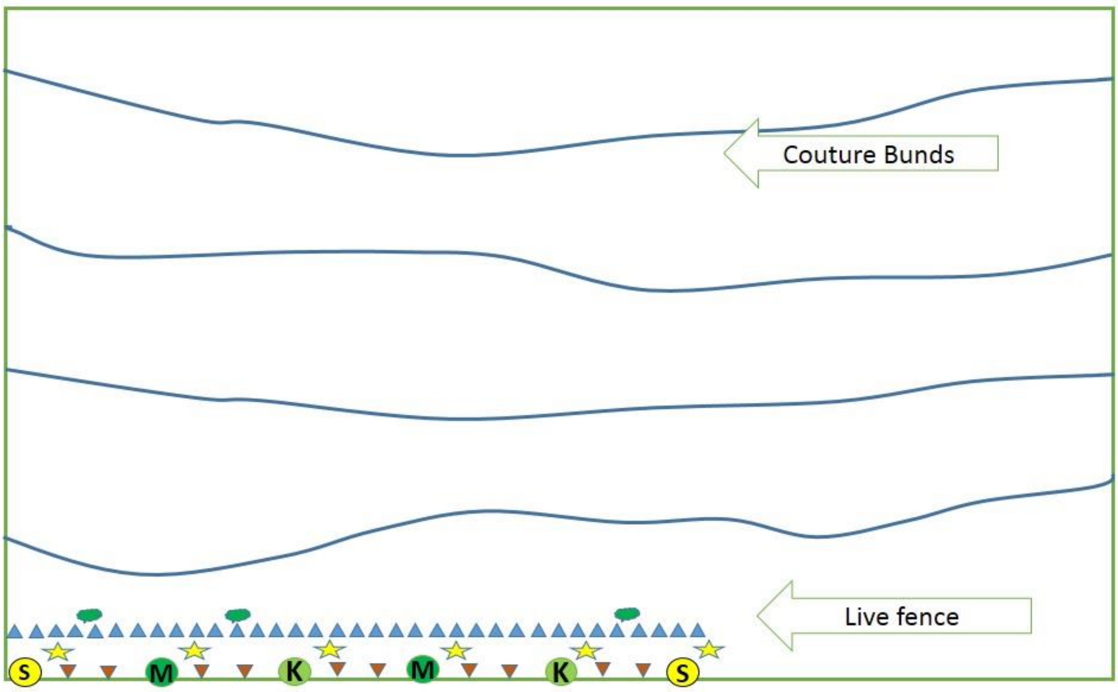
- Live Fence
- Soil and Water Conservation
- **Commercial orchard Cultivation (mango)**
- Multiple Verities of other fruit cultivation
- Multiple Verities of Vegetable cultivation
- Medicinal Plant Cultivation
- Bee keeping
- Compost, organic fertilizer & pesticide Production
- Mango is the main commercial cultivation.
  - Varieties - Karthakoloban or TEJC.
  - Planting Spacing 10m X 05m alone east-west line to get proper sunlight to plants and rest of the parts of the land.

Live fence Layout

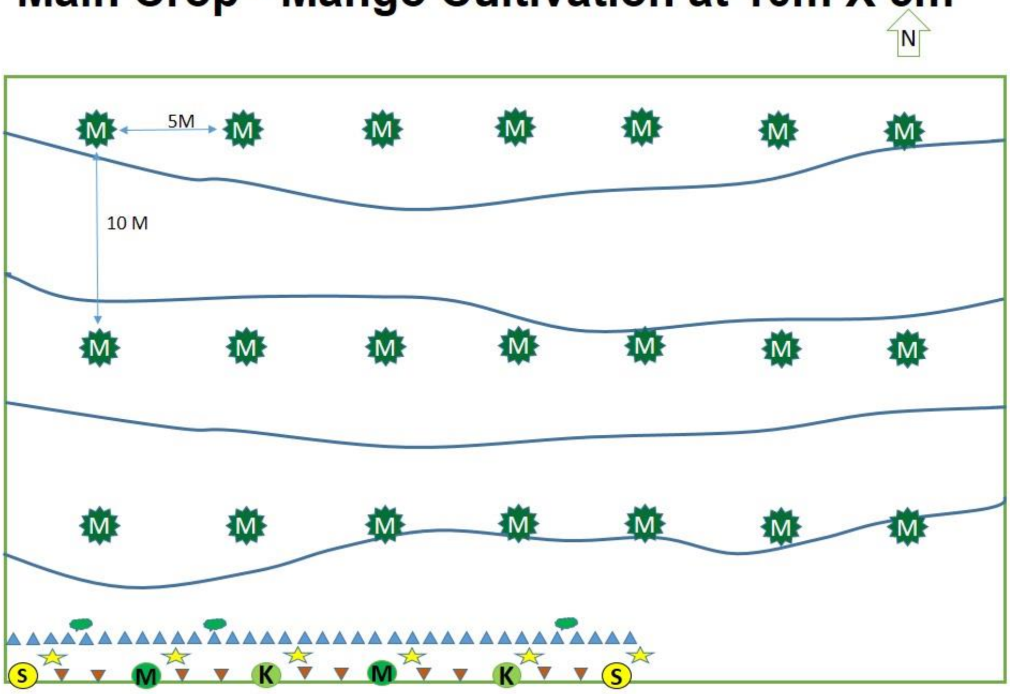
(Glyracediya, Kathurumurunga, Murunga, Gansuriya, Pawatta, Passion Fruit, Kirianguna, Dambala, Awara, Thalkola, Kowakka)



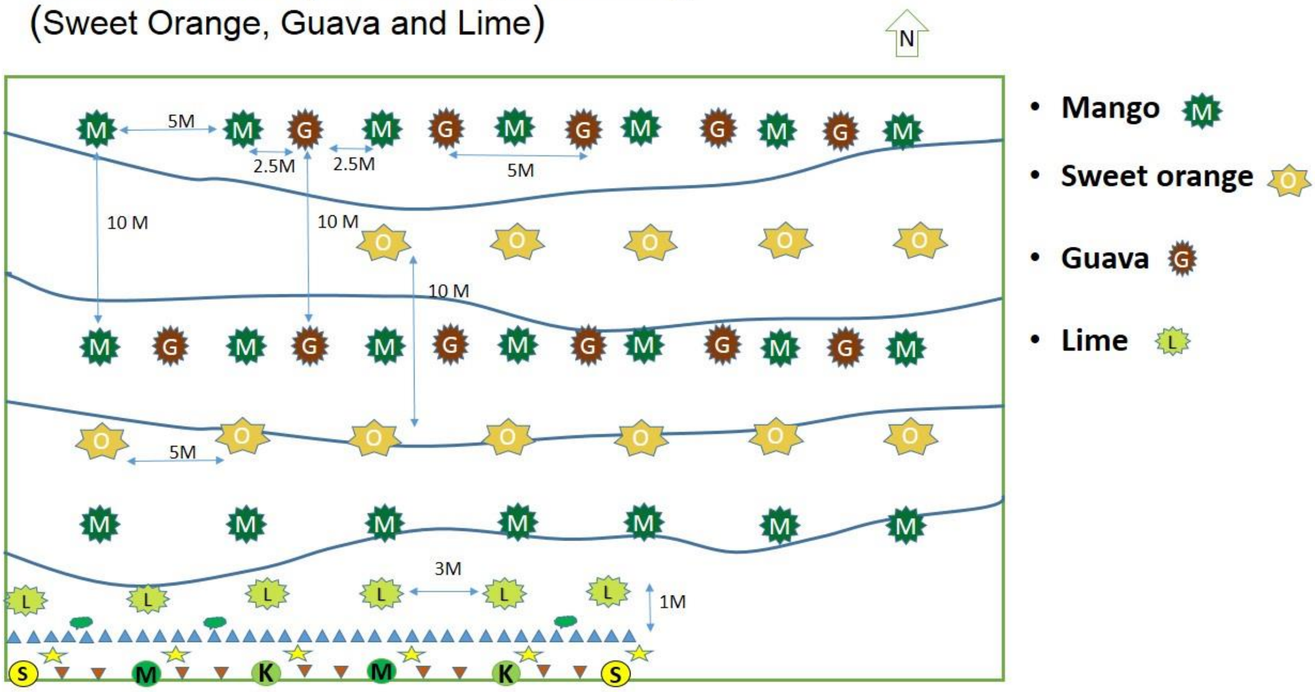
Soil & Rain water conservation Bunds



Main Crop - Mango Cultivation at 10m X 5m



Other fruit crops– *Perennial, Medium Canopy*
(Sweet Orange, Guava and Lime)



<u>Spacing</u>

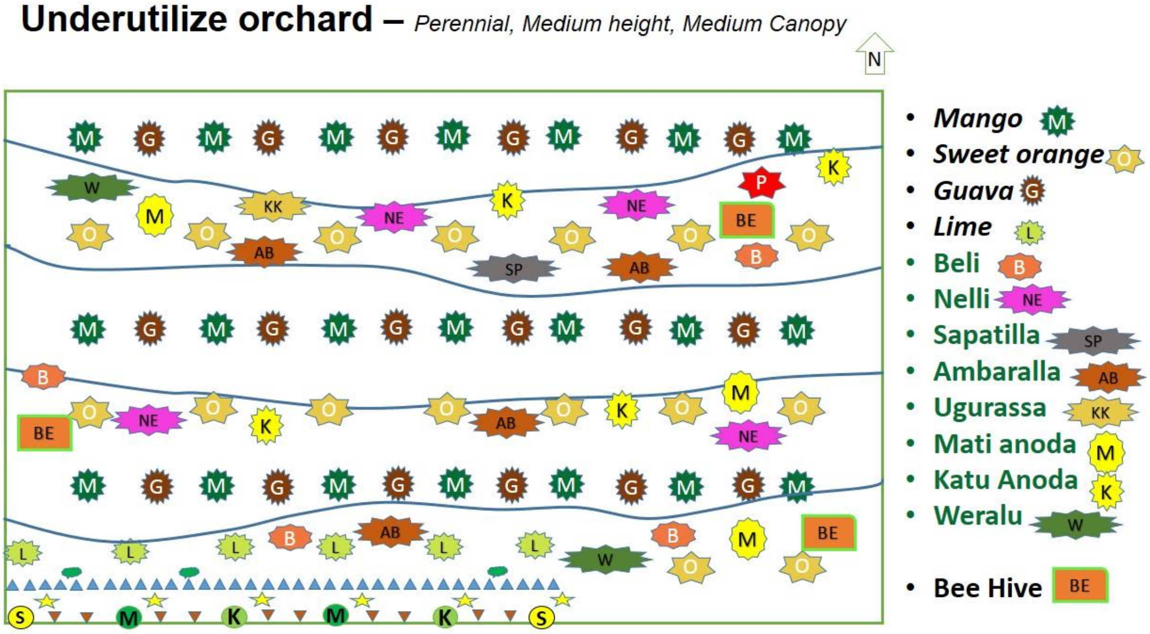
Mango – 5m X 10m as main crop

Sweet orange - 5m X 10m between mango line.

Guava – 5m X 10m in between mango three

Lime – 1m from fence, 3m between plants.

Underutilize orchard – *Perennial, Medium height, Medium Canopy*



Crop Combinations

Main crop

- **Mango**

Other Perennials

- **Sweet Orange**
- **Guava**
- **Lemon**
- **Pomegranate**

Bi Annual

- **Papaya**
- **Passion Fruit**

Annual

- **Sweet melon**
- **Cantaloupe**

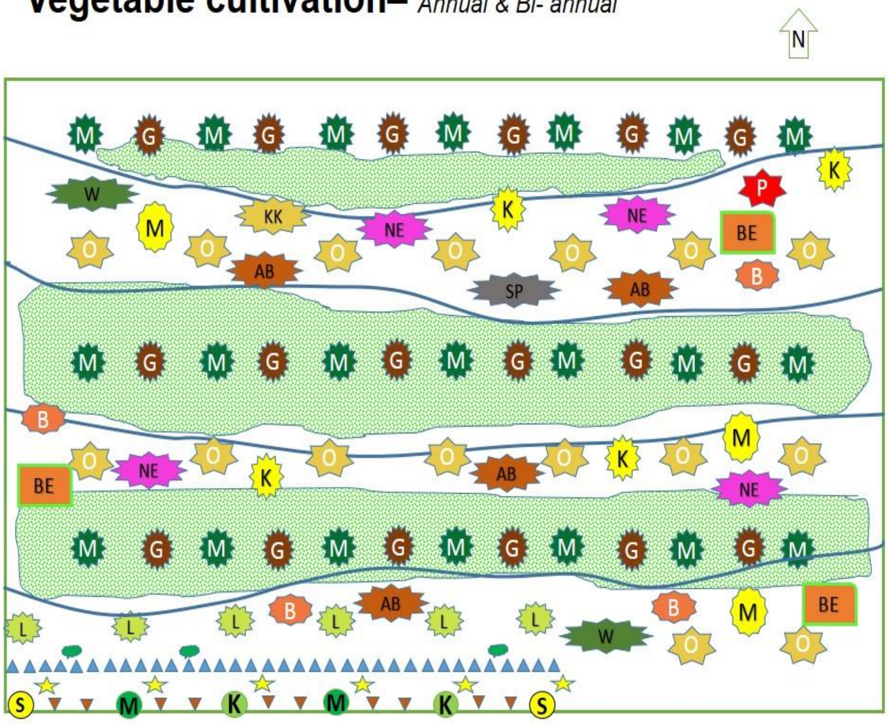
Medicinal Plants

- **Karapincha**
- **Sera**
- **Rampe**
- **Suger cane**
- **Alovera**
- **Sandalwood**

Live fence

- **Gamsooriya**
- **Gliricidi**
- **Moringa**
- **Paawatta**
- **Passion fruit**

Vegetable cultivation– *Annual & Bi- annual*



- Along the bunds, Sera, Alovera and sugarcane.
- Bunds use as structure for Vain crops (pumkin, Kakiri, Sweet melon etc.
- Bi annual bush types (Elabatu, Brinjal) Bi sides of the bunds.
- Other Annual vegetables and yams in between mango and guava plants.
- Vein type crops allow to climb to existing three.

Crop Combinations

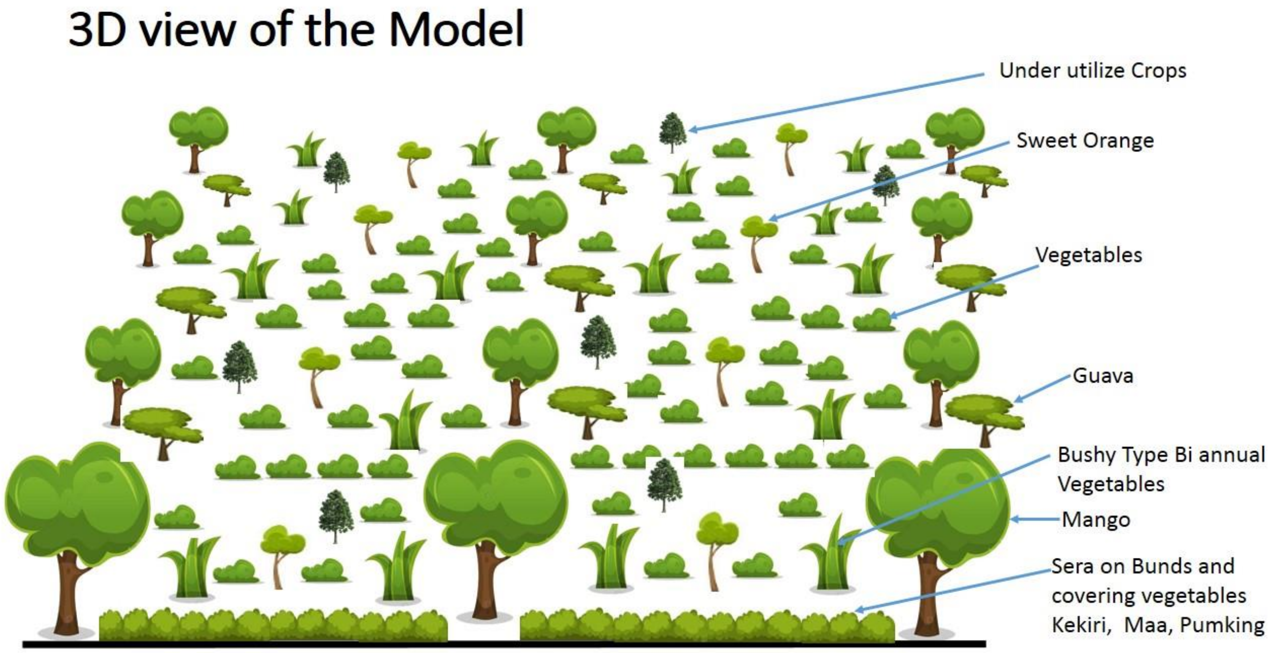
Leguminacea crops
- Awara
- Dambala (Winged Bean)
- Maa (long Bean)

Solanacea crops
- Chili
- Kochchi
- Capsicum
- Brinjol
- Elabatu
- Tibbatu

Cucurbitacea crops
- Bitter gourd
- Luffa (niyan watakolu)
- Snake gourd
- Pumpkin
- Cucumber
- Sweet melon
- Thumba karawila
- Kekiri
- Alu puhul
- Labu

Yams
- Manioc
- Raja ala
- Innala
- Artichok ala
- Kiri ala

Leaf Crops
- Gotukola
- Mugunuwanna
- KanKun
- Tampala
- Saarana
- Kuura kola
- Kiri Anguna
- Thalkola
- Kowakka



3.2.5-Assumptions and factors considered for this model.

- **Mango** is the main crop and should be maintained with proper pruning and training.
- **Orange and guava** are cultivated in between mango as under crop.
- **Passion fruit –** Re- planting should be done once in four years. Vines are allow to climbed to live fence
- **Mix Vegetables (home garden)** – Will provide daily vegetable needs of the family and excess can be sold through farmers market. This will improve family nutrition and healthy life style.

3.2.6- Estimate for model - 2

No	Crop	Unit	No of Unit	Unit Cost	Total Cost (Rs)
1	Mango (Tom EJC)	Plant	80	250	20,000.00
2	Orange (BibilaSweet)	Plant	80	250	20,000.00
3	Guava (Bangkok Giant)	Plant	80	200	16,000.00
4	Lime	Plant	80	100	8,000.00
5	pomegranate	Plant	10	70	700.00
6	Beli Budded	Plant	2	200	400.00
7	Safodilla	Plant	2	200	400.00
8	Ambarella	Plant	2	200	400.00
9	Uguressa Budded	Plant	2	250	500.00
10	Nelli	Plant	2	70	140.00
11	Mora Budded	Plant	2	200	400.00
12	Mati Anoda	Plant	2	70	140.00
13	Katu Anoda	Plant	10	70	700.00
14	Passion Fruit	Plant	20	50	1,000.00
15	Thibbatu	plant	20	40	800.00
16	Mix Vegetables	1 Sq m	1	50	50.00
17	Kiri Ala	plant	20	20	400.00
18	Bees Honey per Box	Hives	3	1500	4,500.00
19	Pineapple	Plants	50	20	1,000.00
20	Murunga	Plant	60	10	600.00
21	Thumba Karawila	Plant	50	50	2,500.00
22	Live fence	meter	240	100	24,000.00
23	Soil Conservation Bunds(M)	meter	180	100	18,000.00
24	Plastic tank (1000L)	unit	2	15000	30,000.00
25	Alkhathine tubes (0.5 inch) M	meter	600	30	18,000.00
26	Drippers (online adjustable)	Nos	160	30	4,800.00
27	Barrel for organic liquid fertilizer (200L)	Nos	2	2000	4,000.00
	Total - Rs				**177,430.00**

3.2.7-Potential Income

		For 3yrs	For 5yrs	For 7yrs	For 10yrs
1	Mango (Tom EJC)	**80,000**	**1,110,000**	**3,310,000**	**6,910,000**
2	Orange (Bibila sweet)	**0**	**52,000**	**192,000**	**432,000**
3	Guava (Bangkok Giant)	**140,000**	**572,000**	**1,052,000**	**1,772,000**
4	Lime	**0**	**56,000**	**296,000**	**656,000**
5	pomegranate	**1,000**	**16,250**	**34,250**	**61,250**
6	Ambarella	**0**	**0**	**720**	**4,470**
7	Underutilized fruits	**0**	**2,000**	**6,000**	**12,000**
8	Katu Anoda	**6,500**	**16,500**	**26,500**	**41,500**
9	Passion Fruit	**16,000**	**31,000**	**46,000**	**68,500**
10	Thibbatu	**34,000**	**66,000**	**98,000**	**146,000**
11	Mix Vegetables (Home garden)	**180,000**	**300,000**	**420,000**	**600,000**
12	Kiri Ala	**3,000**	**5,000**	**7,000**	**10,000**
13	Bees Honey per Box	**18,000**	**32,400**	**46,800**	**68,400**
14	Murunga	**36,000**	**84,000**	**132,000**	**204,000**
15	Gliricidia	**7,200**	**13,600**	**20,000**	**29,600**
16	Pawatta(Per meter)	**26,400**	**55,200**	**84,000**	**127,200**
	Total-Rs	548,100	2,411,950	5,771,270	11,142,920

3.2.8-Finacial indicators based on gross margins

MODEL 2	year 1	year 2	year 3	year 4	year 5	year 6	year 7	year 8	year 9	year 10
Income	68,100	146,200	300,200	750,950	1,077,700	1,551,820	1,772,300	1,772,950	1,772,950	1,772,950
Cost	355,830	180,000	180,000	450,000	450,000	500,000	500,000	500,000	500,000	500,000
Profit	-287,730	-33,800	120,200	300,950	627,700	1,051,820	1,272,300	1,272,950	1,272,950	1,272,950
Income/cost Ratio	0.19	0.81	1.67	1.67	2.39	3.10	3.54	3.55	3.55	3.55
Income/cost %	19.14	81.22	166.78	166.88	239.49	310.36	354.46	354.59	354.59	354.59
Profit/Cost Ratio	-0.81	-0.19	0.67	0.67	1.39	2.10	2.54	2.55	2.55	2.55
Profit/Cost %	-80.86	-18.78	66.78	66.88	139.49	210.36	254.46	254.59	254.59	254.59

Cumulative Income	68,100	214,300	514,500	1,265,450	2,343,150	3,894,970	5,667,270	7,440,220	9,213,170	10,986,120
Cumulative Cost	355,830	535,830	715,830	1,165,830	1,615,830	2,115,830	2,615,830	3,115,830	3,615,830	4,115,830
Cumulative profit	-287,730	-321,530	-201,330	99,620	727,320	1,779,140	3,051,440	4,324,390	5,597,340	6,870,290

Income/cost Ratio	0.19	0.40	0.72	1.09	1.45	1.84	2.17	2.39	2.55	2.67
Income/cost %	19.14	39.99	71.87	108.54	145.01	184.09	216.65	238.79	254.80	266.92
Profit/Cost Ratio	-0.81	-0.60	-0.28	0.09	0.45	0.84	1.17	1.39	1.55	1.67
Profit/Cost %	-80.86	-60.01	-28.13	8.54	45.01	84.09	116.65	138.79	154.80	166.92

Model 3

Farm Development - Rain water harvesting and utilization. - 1Ac

3.3.1 - Proposed extent of the model-1 Ac-

At present both these districts are experiencing severe ground water scarcity for cultivation. Mainly majority of farmers depend on rain water and during the heavy rainy season excess water tends to run off. This model has developed to conserve rain water as much as possible and to utilize later in purposeful manner**.** Three zones have identified according to the moisture availability in the land and crops have recommended accordingly

3.3.2 Labor requirement – family and hired labor.

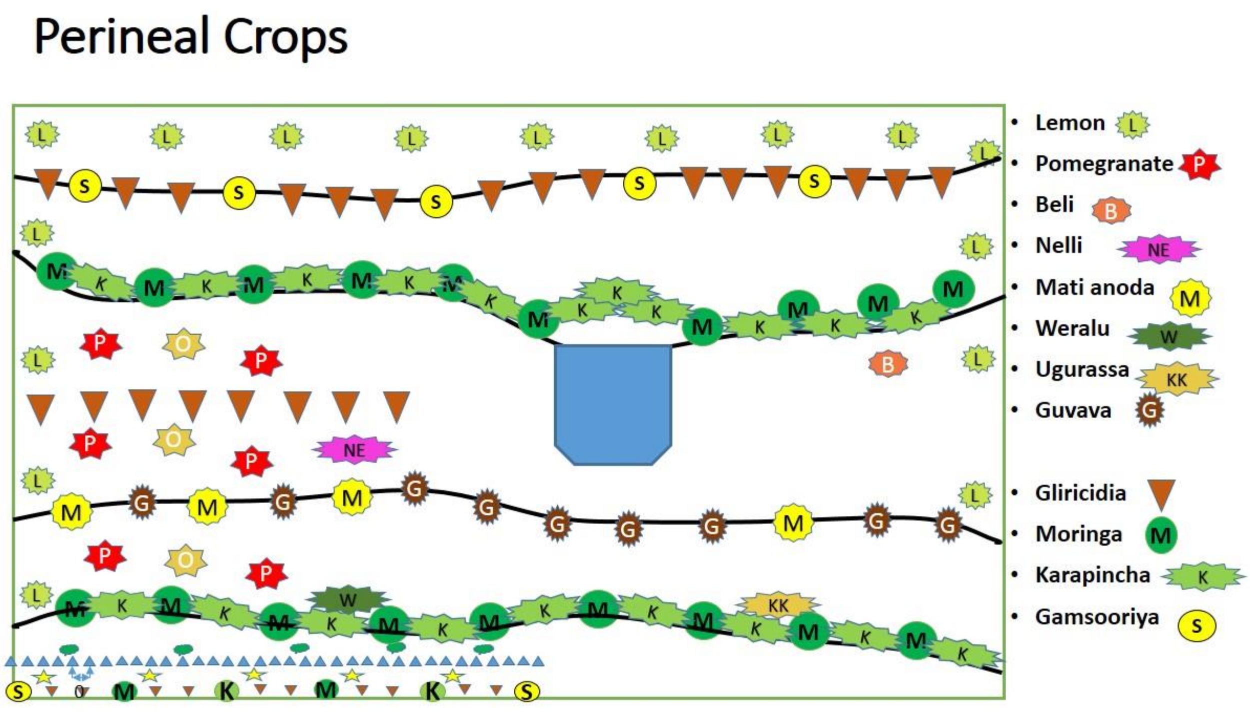
3.3.3 - Crops, spacing, varieties and number of plants

-Shown in the digital design .Main objective of this model is to improve and conserve biodiversity while ensuring additional income and food security. Model has developed for maximum utilization of the land to include number of other crops. Priority has given to conserve water during rainy season and to utilize it during dry period to cultivate some short term crops. Cultivation is done on contours and crop selection will be done to suit to moister availability in different zones.

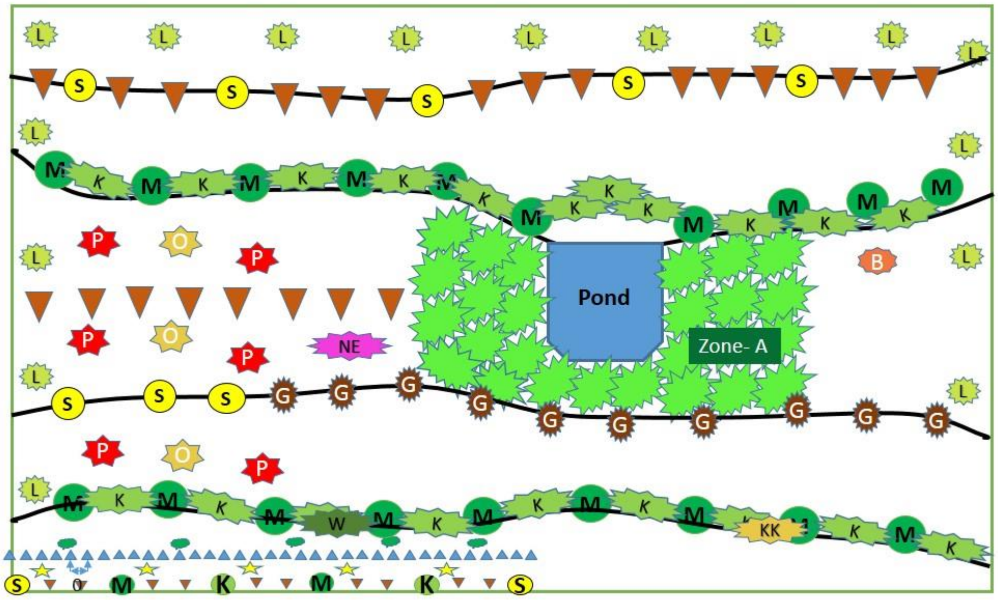
3.3.4-Various elements and field lay out

Model 4

Farm development with rain water harvesting and utilization. (1 Acre)

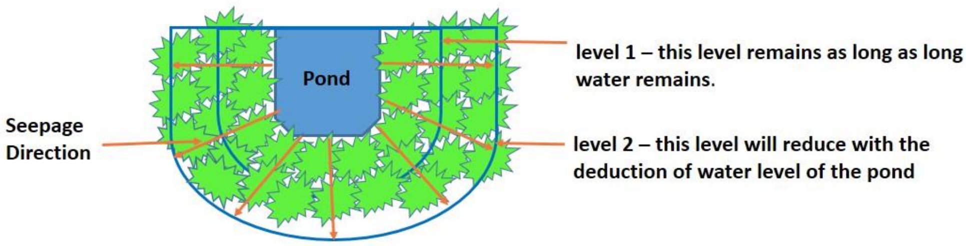


Cultivation **Zone- A** – *High Moisture Area*

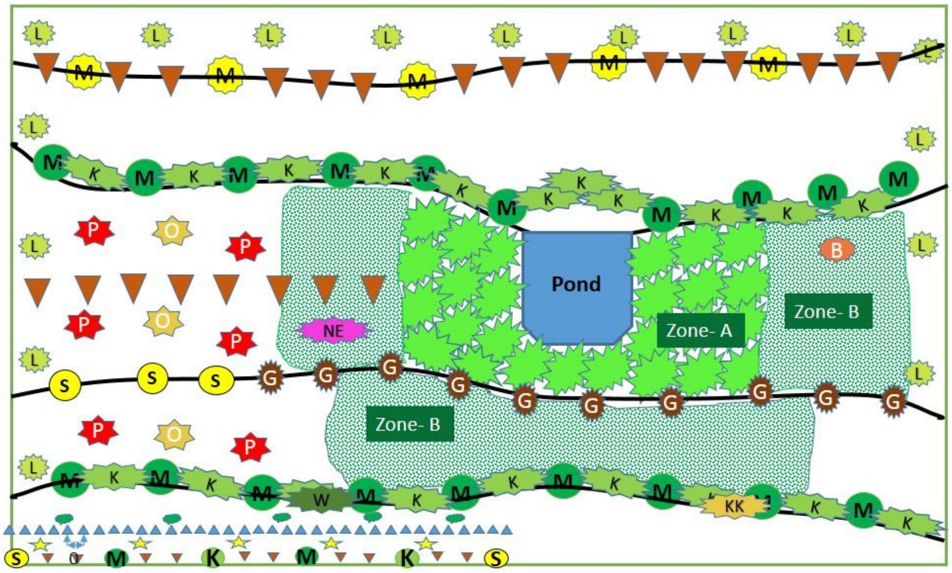


Zone- A – *High Moisture Area*

- Too closer to Rain water harvesting Pond.
- Contain seepage moisture by pond.
- **Most suitable for moisture loving Crops.**
- **Banana, Kiri ala, Ginger, Turmeric. Sweet Potato.**
- **Gotukola, Mugunuwanna, KanKun.**

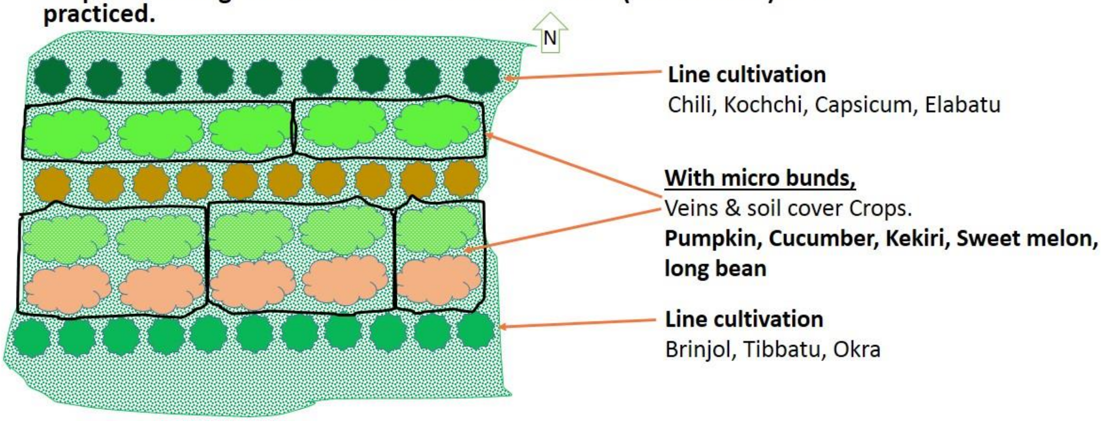


Cultivation **Zone- B** – Mid Moisture Area

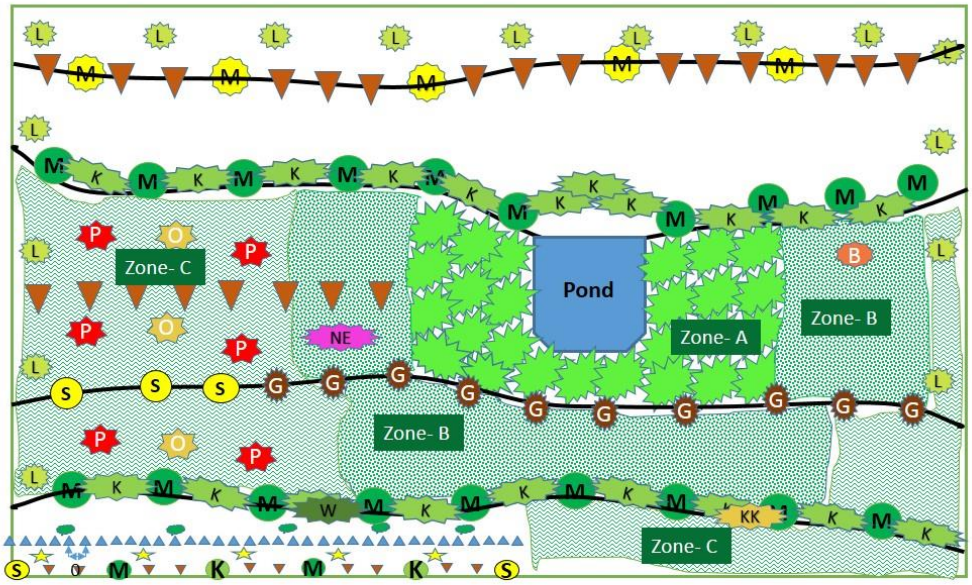


Zone- B – Mid Moisture Area

- Bit Closer to Rain water harvesting Pond.
- Contain less moisture than zone-A
- **Suitable for Vegetable cultivation with irrigation by Pond water.**
- **Proper mulching and water conservation methods (small bunds) to be practiced.**



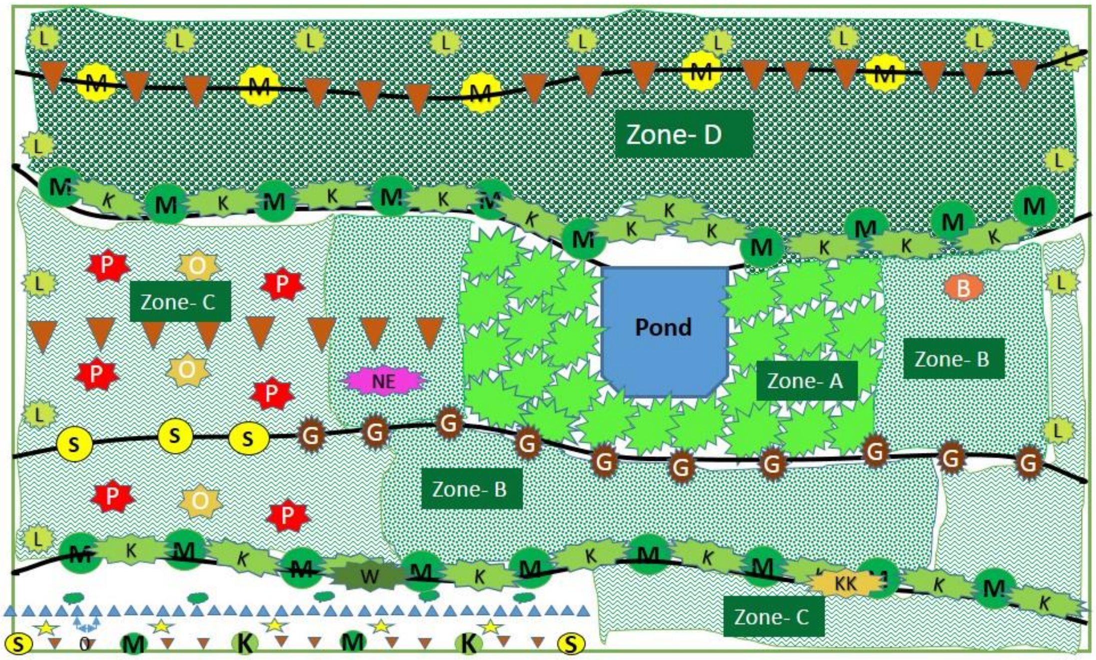
Cultivation **Zone- C** – *low Moisture Area*



Zone- C– *low Moisture Area*

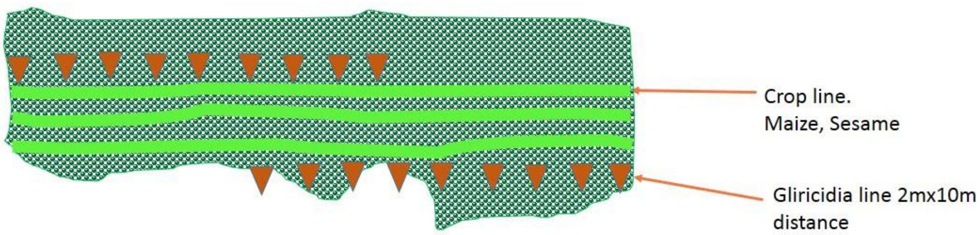
- Bit far to Rain water harvesting Pond.
- No seepage moisture by pond.
- **Most suitable for less moisture required Crops and irrigated crops.**
- **Ground nut, Cowpea, Green gram, Soya bean etc.**
- **Gliricidia line to be cultivated parallel to contour line, it helps maintain moisture loss of the field.**

Cultivation **Zone- D** – *low Moisture Area*

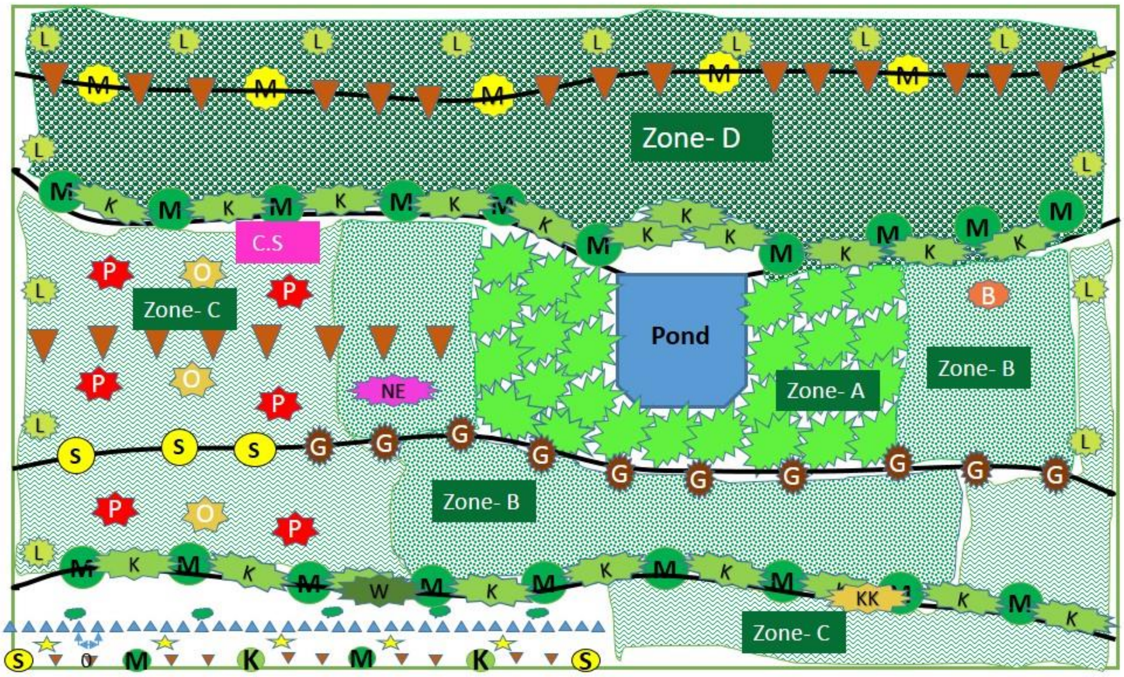


Zone- D – *low Moisture Area (upper of the Pond)*

- Above to Rain water harvesting Pond.
- No received moisture by pond. As a slope existing moisture also seepage to lower part.
- **Most suitable less moisture required crops such as Maize, sesame.**
- **Gliricidia line to be cultivated parallel to contour line, it helps maintain moisture loss of the field.**



Animal Husbandry unit



C.S

Shad for
Cattle or Goat

3.3.5-- Estimate for model – 3

	Crop	**Unit**	**No of Unit**	**Unit Cost**	**Total Cost**
	Lime	Plant	80	100	8,000.00
	Pomegranate	Plant	20	70	1,400.00
	Beli Budded	Plant	2	200	400.00
	Safodilla	Plant	2	200	400.00
	Ambarella	Plant	2	200	400.00
	Uguressa Budded	Plant	2	250	500.00
	Nelli	Plant	2	70	140.00
	Mora Budded	Plant	2	200	400.00
	mati Anoda	Plant	4	70	280.00
	Katu Anoda	Plant	20	70	1,400.00
	Banana Kolikuttu	Plant	50	150	7,500.00
	Papaya Hybrid	Plant	20	50	1,000.00
	Passion Fruit	Plant	60	50	3,000.00
	Thibbatu	plant	20	40	800.00
	Mix Vegetables	1 Sq m	1	50	50.00
	Kiri Ala	plant	150	20	3,000.00
	Bees Honey per Box	Hives	4	1500	6,000.00
	Goat shade with two goats	Unit	1	100,000	100,000.00
	Murunga	plant	50	10	500.00
	Thumba Karawila	plant	50	50	2,500.00
	Pumpkin	plant	100	5	500.00
	Kekiri	plant	100	5	500.00
	Ash Pumping	plant	100	5	500.00
	Cucumber	plant	100	5	500.00
	Sweet Melon	plant	100	5	500.00
	Maize for Grain	Sq m	1000	2	2,000.00
	Gingerly In Yala	Sq m	1000	1	1,000.00
	Groundnut Maha	Sq m	1000	5	5,000.00
	Black gram Yala	Sq m	1000	1	1,000.00
	Green gram Maha	Sq m	500	1	500.00
	Green gram Yala	Sq m	500	1	500.00
	Live fence	meter	240	100	24,000.00
	Rain water Harvesting Tank (280 CubM)	unit	1	80000	80,000.00
	Soil Conservation Bunds	meter	250	100	25,000.00
	Total				**279,170.00**

3.3.6-Income forecast for model 3

-					
	Crop	**for 3yrs**	**for 5yrs**	**for 7yrs**	**for 10yrs**
1	Mango (Tom EJC)	**20,000**	**277,500**	**827,500**	**1,727,500**
2	Mango (Kartha Colomban)	**0**	**30,000**	**237,000**	**642,000**
3	Orange (Bibila sweet)	**0**	**6,500**	**24,000**	**54,000**
4	Guava(Bangkok Giant)	**35,000**	**143,000**	**263,000**	**443,000**
5	Lime	**0**	**56,000**	**296,000**	**656,000**
6	Pomegranate	**2,000**	**32,500**	**68,500**	**122,500**
7	Ambarella	**0**	**0**	**720**	**4,470**
8	Nelli	**0**	**2,000**	**6,000**	**12,000**
9	Katu Anoda	**13,000**	**33,000**	**53,000**	**83,000**
10	Banana (Kolikuttu)	**240,000**	**540,000**	**840,000**	**1,290,000**
11	Papaya Hybrid	**100,000**	**205,000**	**310,000**	**467,500**
12	Passion Fruit	**48,000**	**93,000**	**138,000**	**205,500**
13	Thibbatu	**34,000**	**66,000**	**98,000**	**146,000**
14	Mix Vegetables (Home consumption)	**180,000**	**300,000**	**420,000**	**600,000**
15	Kiri Ala	**22,500**	**37,500**	**52,500**	**75,000**
16	Bees Honey per Box	**24,000**	**43,200**	**62,400**	**91,200**
17	Pineapple	**250**	**450**	**650**	**950**
18	Murunga	**30,000**	**70,000**	**110,000**	**170,000**
19	Thumba Karawila	**15,000**	**25,000**	**35,000**	**50,000**
20	Karapincha	**30,000**	**50,000**	**70,000**	**100,000**
21	Pumpking	**48,000**	**80,000**	**112,000**	**160,000**
22	Kekiri	**12,000**	**20,000**	**28,000**	**40,000**
23	Ash Pumking	**18,000**	**30,000**	**42,000**	**60,000**
24	Cucumber	**12,000**	**20,000**	**28,000**	**40,000**
25	Sweet Melon	**27,000**	**45,000**	**63,000**	**90,000**
26	Maize for Grain	**75,000**	**125,000**	**175,000**	**250,000**
27	Gingerly In Yala	**300,000**	**500,000**	**700,000**	**1,000,000**
28	Groundnut Maha	**67,500**	**112,500**	**157,500**	**352,500**
29	Blackgram Yala	**60,000**	**180,000**	**220,000**	**280,000**
30	Greengram Maha	**22,500**	**37,500**	**52,500**	**75,000**
31	Greengram Yala	**22,500**	**37,500**	**52,500**	**75,000**
32	Gliricidia	**7,200**	**13,600**	**20,000**	**29,600**
33	Pawatta	**26,400**	**55,200**	**84,000**	**127,200**
	Total	1,491,850	3,266,950	5,646,770	9,519,920

3.3.7-Financial indicators based on gross margins

MODEL 3	year 1	year 2	year 3	year 4	year 5	year 6	year 7	year 8	year 9	year 10
Income	159,350	355,200	471,200	605,700	739,200	956,820	1,072,800	1,073,450	1,073,450	1,073,450
Cost	359,170	180,000	180,000	320,000	320,000	320,000	320,000	320,000	320,000	320,000
Profit	-199,820	175,200	291,200	285,700	419,200	636,820	752,800	753,450	753,450	753,450
Income/cost Ratio	0.44	1.97	2.62	1.89	2.31	2.99	3.35	3.35	3.35	3.35
Income/cost %	44.37	197.33	261.78	189.28	231.00	299.01	335.25	335.45	335.45	335.45
Profit/Cost Ratio	-0.56	0.97	1.62	0.89	1.31	1.99	2.35	2.35	2.35	2.35
Profit/Cost %	-55.63	97.33	161.78	89.28	131.00	199.01	235.25	235.45	235.45	235.45

Cumulative Income	159,350	514,550	985,750	1,591,450	2,330,650	3,287,470	4,360,270	5,433,720	6,507,170	7,580,620
Cumulative Cost	359,170	539,170	719,170	1,039,170	1,359,170	1,679,170	1,999,170	2,319,170	2,639,170	2,959,170
Cumulative profit	-199,820	-24,620	266,580	552,280	971,480	1,608,300	2,361,100	3,114,550	3,868,000	4,621,450

Income/cost Ratio	0.44	0.95	1.37	1.53	1.71	1.96	2.18	2.34	2.47	2.56
Income/cost %	44.37	95.43	137.07	153.15	171.48	195.78	218.10	234.30	246.56	256.17
Profit/Cost Ratio	-0.56	-0.05	0.37	0.53	0.71	0.96	1.18	1.34	1.47	1.56
Profit/Cost %	-55.63	-4.57	37.07	53.15	71.48	95.78	118.10	134.30	146.56	156.17

Model -4

Chena Stabilization. (1 – Ac)

3.4.1-Proposed extent of the model-1 Ac-

Sri Lankan traditional Chena cultivation system had large bio diversity. But presently it has become mono crop cultivation. Present Chena cultivation will cause soil erosion and rain water loss.
With this proposed model it is expected to stabilize the Chena land to get more income with special reference to safe guarding bio diversity. Cultivation will be done on contours and more emphasis will be done to soil conservation techniques, moisture retention and continuous cultivation methods

3.4.2-Labor requirement

-Family labor and hired labor if necessary.

3.4.3-Crop combinations

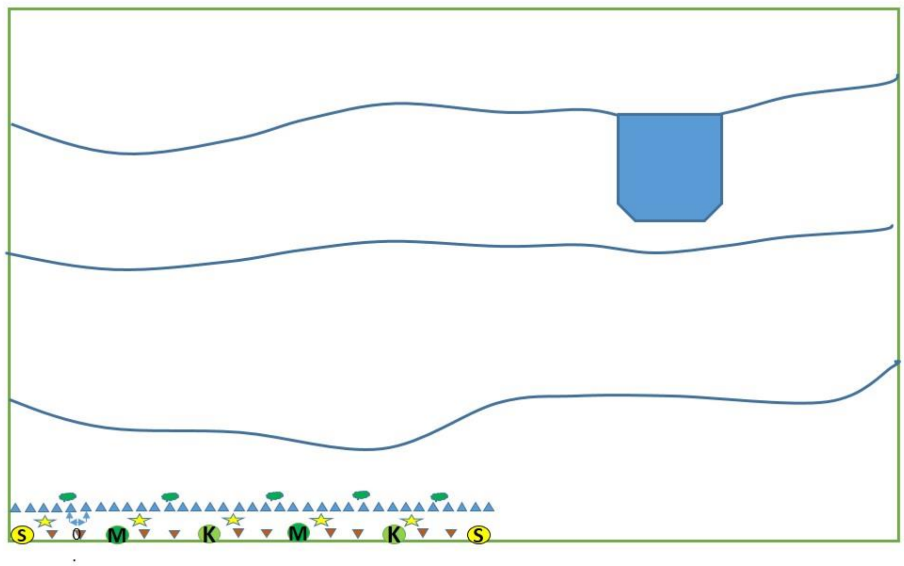
, spacing, varieties and number of plants are shown in the digital design .Main objective of this model is to improve Chena cultivations to conserve biodiversity while ensuring additional income and food security. Model has developed for maximum utilization of the land to include number of other crops. Priority has given to conserve water during rainy season and to utilize it during dry period to cultivate some short term crops. Cultivation is done on contours and crop selection will be done to suit to moister availability of different zones.

3.4.4-Various elements of the model and field lay out

Model -4

Chena stabilization. (1 – Ac)

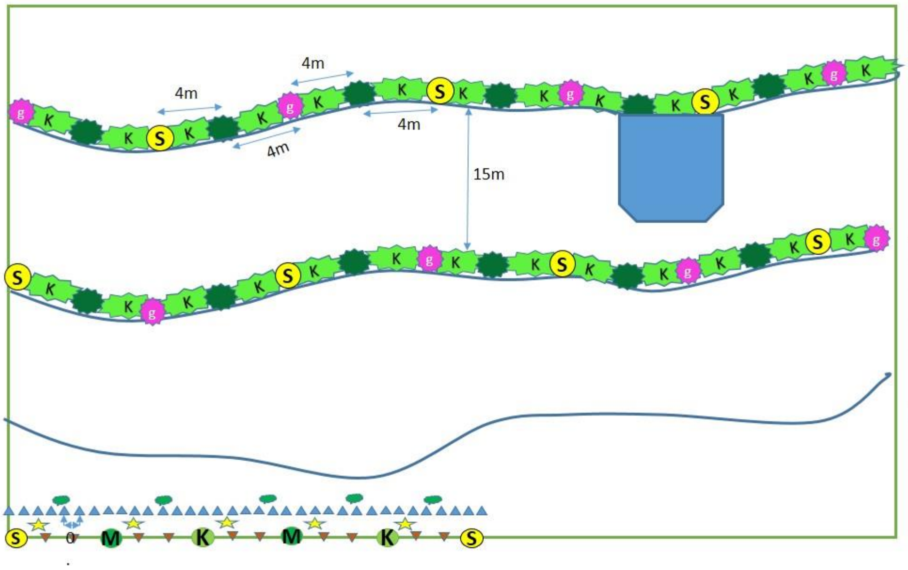
Soil conservation bunds and Rainwater Harvesting pond.



Extent – 1 Ac

- **Minimum 3 bunds to cover whole land to conserve rain water and reduce top soil erosion.**
- **Rain water harvesting tank will be constructed upper part of the land.**

Soil conservation Live bunds



Soil conservation bunds and dividing lines planting with

- **Karapincha**
- **Murunga**
- **Gliricidia**
- **Gamsooriya**

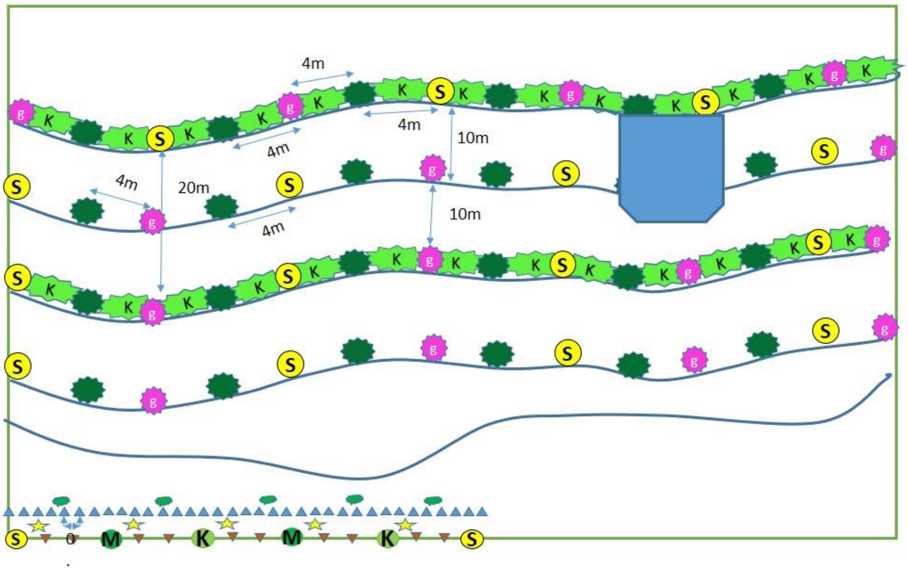
All these plants are,

- **Drawd resistance,**
- **Fast growing,**
- **Nitrogen fixing,**
- **Falling large no of leaves**

It helps,

- **Re-habilitation.**
- **Conserve Soil and Moisture**
- **Fertilization of soil.**

Additional methods to improve bio diversity.



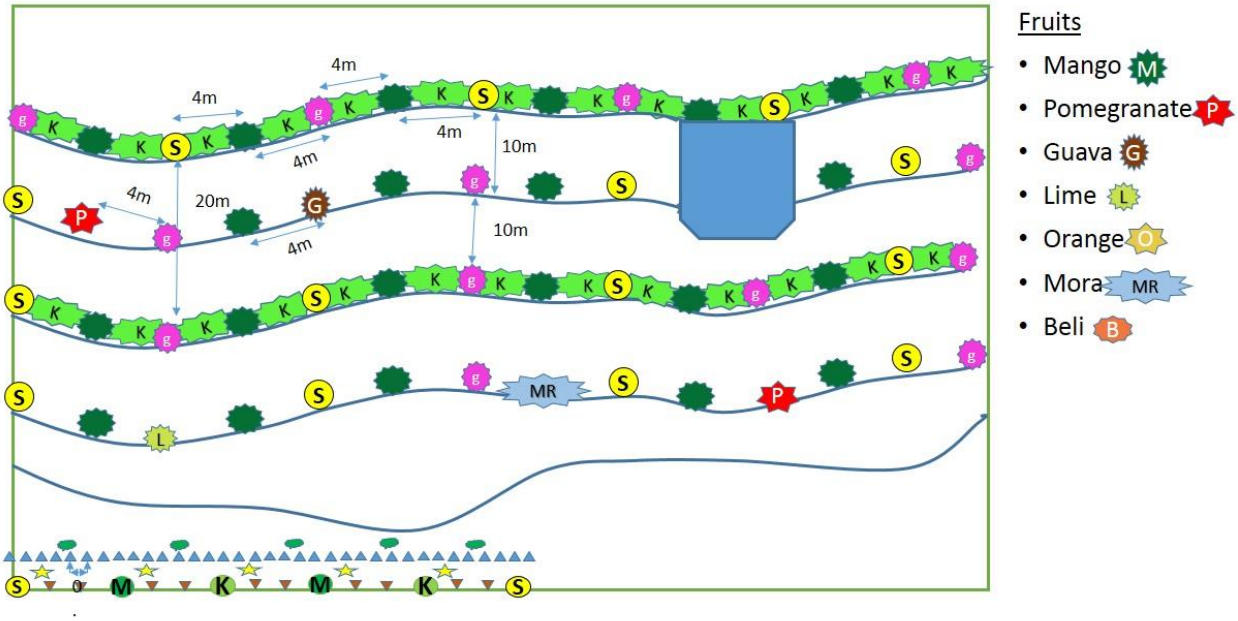
In Between Soil Bunds, additional three line will be cultivated

- Murunga
- Gliricidia
- Gamsooriya

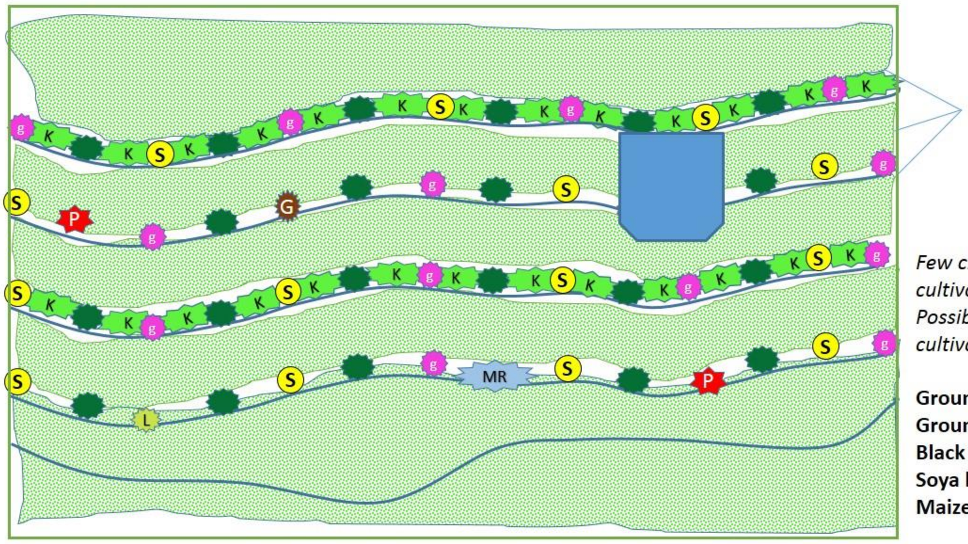
It helps,

- Covering heavy wind damage.
- Conserve Moisture of micro environment.
- Additional soil fertilization and Re-habilitation.

Perennial fruits cultivation.



Crop Combinations.



- **Annual Crop cultivation in between Bunds and tree lines**

Few crops will be cultivated.
Possible crops can be cultivate as mix cropping.

Groundnut + Green gram
Groundnut + Maize
Black gram + Maize
Soya bean + Maize
Maize + Kekiri, Pumking

Crop Combinations.

Field Crops

- Maize
- Groundnut
- Green gram
- Cowpea
- Sesame
- Soya bean
- Chili

Seasonal Crops

- Batu karawila
- Thuba karawila
- Kekiri
- Thiyabara
- Elabatu
- Iramusu
- Polpala
- Koorakola
- Saarana
- Thalkola

Fruits

- Mango
- Pomegranate
- Guava
- Lime
- Orange
- Mora
- Beli

Conserving Existing Forest plants

- Neem
- Ahala
- Maila
- Sattin
- Weera
- Palu
- Demata
- Seru
- Ahu
- Katupila
- Ranawara

3.4.5-Estimate for the model-4

No	Crop	Unit	No of Unit	Unit Cost	Total Cost
0	Fruits				
1	Mango Tom EJC	Plant		250	0.00
2	Mango Kartha Colomban	Plant	5	250	1,250.00
3	Orange Bibila	Plant	10	250	2,500.00
4	Guava Bangkok Giant	Plant	10	200	2,000.00
5	Lime	Plant	80	100	8,000.00
6	Pomogranate	Plant	10	70	700.00
7	Beli Budded	Plant	2	200	400.00
11	Nelli	Plant	1	70	70.00
12	Mora Budded	Plant	2	200	400.00
13	mati Anoda	Plant	2	70	140.00
14	Katu Anoda	Plant	4	70	280.00
22	Bees Honey per Box	Hives	4	1500	6,000.00
25	Murunga	Plant	60	10	600.00
28	Thumba Karawila	Plant	60	50	3,000.00
30	Pumpking	Plant	100	5	500.00
31	Kekiri	Plant	100	5	500.00
32	Ash Pumking	Plant	100	5	500.00
33	Cucumber	Plant	100	5	500.00
34	Sweet Melon	Plant	100	5	500.00
35	Maize for Grain	Sqm	1500	2	3,000.00
36	Gingelly In Yala	Sqm	2000	1	2,000.00
37	Groundnut Maha	Sqm	1000	5	5,000.00
38	Blackgram Yala	Sqm	1000	1	1,000.00
39	Greengram Maha	Sqm	1000	1	1,000.00
40	Greengram Yala	Sqm	500	1	500.00
41	Live fence	meter	350	100	35,000.00
42	Soil Conservation Bunds(M)	meter	350	100	35,000.00
43	Rain water harvesting pond	unit	1	100,000	100,000.00
44	Weed control machine	Unit	1	22,000	22,000.00
45	Clay Pots	Nos		2000	2000.00
Total					**234,340**

3.4.6-Potential income

	Crop	for 3yrs	for 5yrs	for 7yrs	for 10yrs
2	Mango Kartha Colomban	**0**	**7,500**	**59,250**	**160,500**
3	Orange Bibila	**0**	**6,500**	**24,000**	**54,000**
4	Guava Bangkok Giant	**17,500**	**71,500**	**131,500**	**221,500**
5	Lime	**0**	**56,000**	**296,000**	**656,000**
6	Pomogranate	**1,000**	**16,250**	**34,250**	**61,250**
11	Nelli	**0**	**1,000**	**3,000**	**6,000**
14	Katu Anoda	**2,600**	**6,600**	**10,600**	**16,600**
22	Bees Honey per Box	**24,000**	**43,200**	**62,400**	**91,200**
25	Murunga	**36,000**	**84,000**	**132,000**	**204,000**
27	Elabatu	**45,000**	**75,000**	**105,000**	**150,000**
28	Thumba Karawila	**18,000**	**30,000**	**42,000**	**60,000**
29	Karapincha	**30,000**	**50,000**	**70,000**	**100,000**
30	Pumpking	**48,000**	**80,000**	**112,000**	**160,000**
31	Kekiri	**12,000**	**20,000**	**28,000**	**40,000**
32	Ash Pumking	**18,000**	**30,000**	**42,000**	**60,000**
33	Cucumber	**12,000**	**20,000**	**28,000**	**40,000**
34	Sweet Melon	**27,000**	**45,000**	**63,000**	**90,000**
35	Maize for Grain 1sqm	**112,500**	**187,500**	**262,500**	**375,000**
36	Gingelly In Yala 1sqm	**600,000**	**1,000,000**	**1,400,000**	**2,000,000**
37	Groundnut Maha 1sqm	**67,500**	**112,500**	**157,500**	**352,500**
38	Blackgram Yala 1sqm	**60,000**	**180,000**	**220,000**	**280,000**
39	Greengram Maha	**45,000**	**75,000**	**105,000**	**150,000**
40	Greengram Yala	**22,500**	**37,500**	**52,500**	**75,000**
0	Gliricidia	**5,400**	**10,200**	**15,000**	**22,200**
0	Pawatta(Per meter)	**27,500**	**57,500**	**87,500**	**132,500**
	Total	1,231,500	2,302,750	3,543,000	5,558,250

3.4.7-Financial indicators based on gross margins

MODEL 4	year 1	year 2	year 3	year 4	year 5	year 6	year 7	year 8	year 9	year 10
Income	112,500	135,100	156,000	191,350	235,100	328,600	346,850	346,850	346,850	346,850
Cost	340,390	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000
Profit	-227,890	10,100	31,000	66,350	110,100	203,600	221,850	221,850	221,850	221,850
Income/cost Ratio	0.33	1.08	1.25	1.53	1.88	2.63	2.77	2.77	2.77	2.77
Income/cost %	33.05	108.08	124.80	153.08	188.08	262.88	277.48	277.48	277.48	277.48
Profit/Cost Ratio	-0.67	0.08	0.25	0.53	0.88	1.63	1.77	1.77	1.77	1.77
Profit/Cost %	-66.95	8.08	24.80	53.08	88.08	162.88	177.48	177.48	177.48	177.48

Cumulative Income	112,500	247,600	403,600	594,950	830,050	1,158,650	1,505,500	1,852,350	2,199,200	2,546,050
Cumulative Cost	340,390	465,390	590,390	715,390	840,390	965,390	1,090,390	1,215,390	1,340,390	1,465,390
Cumulative profit	-227,890	-217,790	-186,790	-120,440	-10,340	193,260	415,110	636,960	858,810	1,080,660

Income/cost Ratio	0.33	0.53	0.68	0.83	0.99	1.20	1.38	1.52	1.64	1.74
Income/cost %	33.05	53.20	68.36	83.16	98.77	120.02	138.07	152.41	164.07	173.75
Profit/Cost Ratio	-0.67	-0.47	-0.32	-0.17	-0.01	0.20	0.38	0.52	0.64	0.74
Profit/Cost %	-66.95	-46.80	-31.64	-16.84	-1.23	20.02	38.07	52.41	64.07	73.75

Model- 5

Mahaewli paddy land development

3.5.1-Proposed extent of the model-2.5 Ac

In Anuradapura district there are lot of paddy lands under mahaweli scheme.Paddy lands under Kalawewa scheme are unable to cultivate in both seasons due to scarcity of water. It is said that there are more than 1000 ha under Kalawewa scheme which does not get enough water in to do paddy cultivation in both seasons. On the other hand cultivation of OFC is more profitable than paddy cultivation and water requirement for OFCs is also much lesser compared to paddy .It was revealed that these Mahaweli farmers under Kalawewa could not cultivate their paddy fields during last three years due to water scarcity .Diversification of paddy lands to cultivate other filed crops will improve biodiversity and farmers income. This Mahaweli paddy land development model designed to overcome above mentioned problems and also to improve biodiversity.

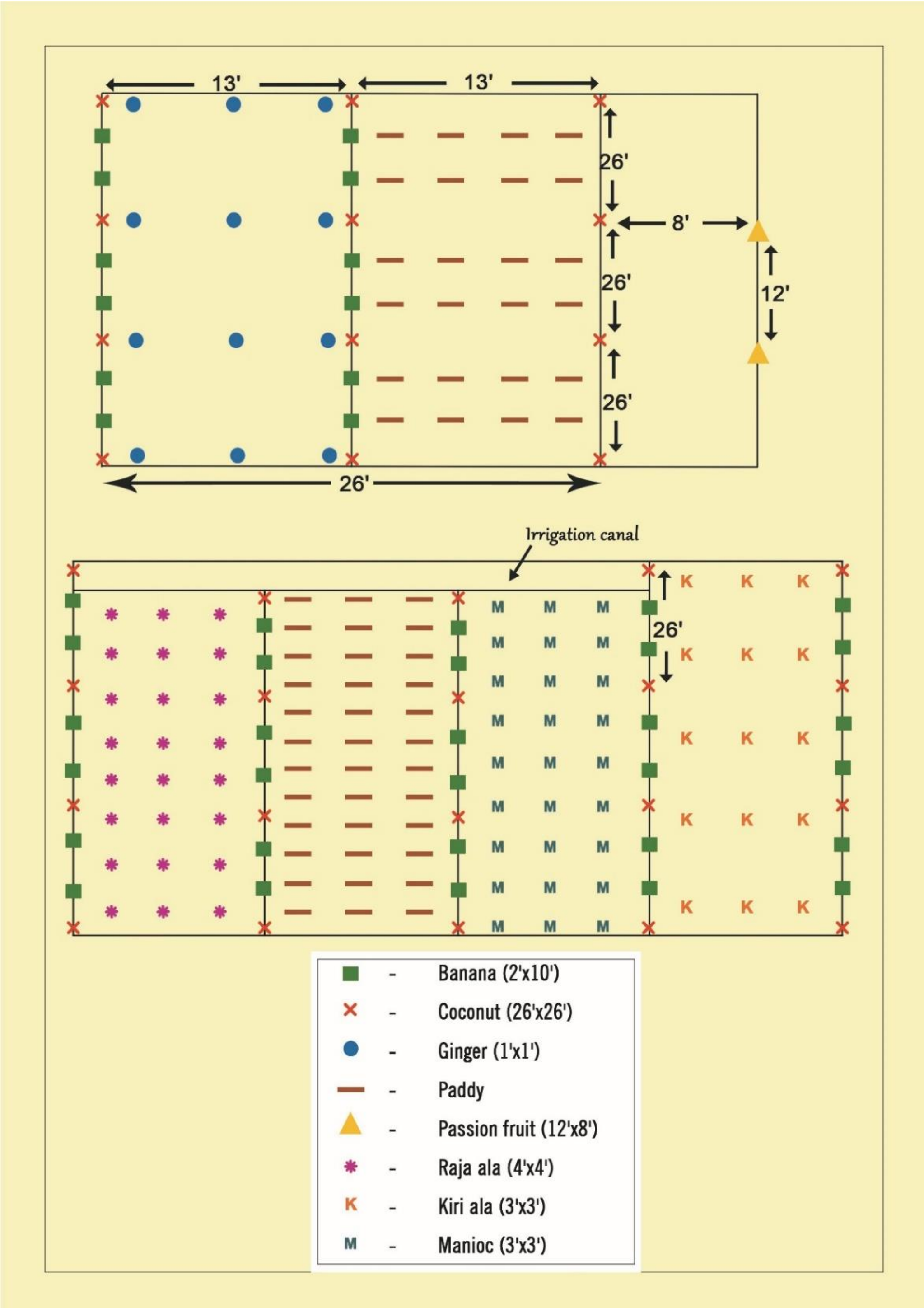
3.5.2-Labor requirement-This Model will have to use hired labor.

3.5.3-Crop combinations, spacing, varieties and number of plants

Shown in the digital design .Main objective of this model is to improve biodiversity in paddy cultivation while ensuring additional income and food security. Model has developed for maximum utilization of the land to include number of other crops. Priority has given to cultivate various crops which have big market demand. Another very important feature of this model is the ability to get a substantial income on weekly basis.

3.5.4-Various elements of the model and field lay out

Crop selection and spacing.



3.5.5-Estimate for the model-5

	Crop	**Unit**	**No of Unit**	**Unit Cost**	**Total Cost**
1	Banana		700	100	70,000.00
2	Passion Fruit (Per wine)	Plant	200	30	6,000.00
3	Wel Ala (per wine)	Plant	1400	30	42,000.00
4	Coconut	Plant	160	150	24,000.00
5	Kohila Ala	Sq m	1440	30	43,200.00
6	Kohila Dandu (Miti)/sqm	Sq m	1440	0	0
7	Paddy	Sq m	4000	5	20,000.00
8	Labor cost (Per Month)	Man Date	50	1500	75000.00
Total					**280,200.00**

3.5.6-Potential income –model 5

	Crop	**for 3yrs**	**for 5yrs**	**for 7yrs**	**for 10yrs**
1	Banana	**4,200,000**	**8,400,000**	**12,600,000**	**18,900,000**
2	Passion Fruit (Per wine)	**320,000**	**640,000**	**960,000**	**1,440,000**
3	Wel Ala (per wine)	**1,260,000**	**2,100,000**	**2,940,000**	**4,200,000**
4	Coconut	**0**	**0**	**1,088,000**	**3,392,000**
5	Kohila Ala	**103,680**	**172,800**	**241,920**	**345,600**
6	Kohila Dandu (Miti)/sqm	**97,200**	**162,000**	**226,800**	**507,600**
7	Paddy	**288,000**	**480,000**	**672,000**	**960,000**
Total					29,745,200

3.5.7-Financial indicators based on gross margins

MODEL 5	year 1	year 2	year 3	year 4	year 5	year 6	year 7	year 8	year 9	year 10
Income	1,260,000	1,840,000	2,680,000	2,680,000	2,680,000	3,000,000	3,448,000	3,448,000	3,448,000	3,448,000
Cost	1,105,200	900,000	900,000	900,000	900,000	900,000	900,000	900,000	900,000	900,000
Profit	154,800	940,000	1,780,000	1,780,000	1,780,000	2,100,000	2,548,000	2,548,000	2,548,000	2,548,000
Income/cost Ratio	1.14	2.04	2.98	2.98	2.98	3.33	3.83	3.83	3.83	3.83
Income/cost %	114.01	204.44	297.78	297.78	297.78	333.33	383.11	383.11	383.11	383.11
Profit/Cost Ratio	0.14	1.04	1.98	1.98	1.98	2.33	2.83	2.83	2.83	2.83
Profit/Cost %	14.01	104.44	197.78	197.78	197.78	233.33	283.11	283.11	283.11	283.11

Cumulative Income	1,260,000	3,100,000	5,780,000	8,460,000	11,140,000	14,140,000	17,588,000	21,036,000	24,484,000	27,932,000
Cumulative Cost	1,105,200	2,005,200	2,905,200	3,805,200	4,705,200	5,605,200	6,505,200	7,405,200	8,305,200	9,205,200
Cumulative profit	154,800	1,094,800	2,874,800	4,654,800	6,434,800	8,534,800	11,082,800	13,630,800	16,178,800	18,726,800

Income/cost Ratio	1.14	1.55	1.99	2.22	2.37	2.52	2.70	2.84	2.95	3.03
Income/cost %	114.01	154.60	198.95	222.33	236.76	252.27	270.37	284.07	294.80	303.44
Profit/Cost Ratio	0.14	0.55	0.99	1.22	1.37	1.52	1.70	1.84	1.95	2.03
Profit/Cost %	14.01	54.60	98.95	122.33	136.76	152.27	170.37	184.07	194.80	203.44

Benefit cost analysis of the 5 models

MODEL 1	year 1	year 2	year 3	year 4	year 5	year 6	year 7	year 8	year 9	year 10	Benefit/Cost Ratio
Income	82,600	248,375	405,025	475,075	533,200	595,745	643,975	583,400	644,625	644,625	
Cost	392,790	180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000	180,000	
	-310,190	68,375	225,025	295,075	353,200	415,745	463,975	403,400	464,625	464,625	
MODEL 2	year 1	year 2	year 3	year 4	year 5	year 6	year 7	year 8	year 9	year 10	67%
Income	68,100	146,200	300,200	750,950	1,077,700	1,551,820	1,772,300	1,772,950	1,772,950	1,772,950	
Cost	355,830	180,000	180,000	450,000	450,000	500,000	500,000	500,000	500,000	500,000	
	-287,730	-33,800	120,200	300,950	627,700	1,051,820	1,272,300	1,272,950	1,272,950	1,272,950	
MODEL 3	year 1	year 2	year 3	year 4	year 5	year 6	year 7	year 8	year 9	year 10	76%
Income	159,350	355,200	471,200	605,700	739,200	956,820	1,072,800	1,073,450	1,073,450	1,073,450	
Cost	359,170	180,000	180,000	320,000	320,000	320,000	320,000	320,000	320,000	320,000	
	-199,820	175,200	291,200	285,700	419,200	636,820	752,800	753,450	753,450	753,450	
MODEL 4	year 1	year 2	year 3	year 4	year 5	year 6	year 7	year 8	year 9	year 10	124%
Income	112,500	135,100	156,000	191,350	235,100	328,600	346,850	346,850	346,850	346,850	
Cost	340,390	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	
	-227,890	10,100	31,000	66,350	110,100	203,600	221,850	221,850	221,850	221,850	
MODEL 5	year 1	year 2	year 3	year 4	year 5	year 6	year 7	year 8	year 9	year 10	35%
Income	1,260,000	1,840,000	2,680,000	2,680,000	2,680,000	3,000,000	3,448,000	3,448,000	3,448,000	3,448,000	
Cost	1,105,200	900,000	900,000	900,000	900,000	900,000	900,000	900,000	900,000	900,000	
	154,800	940,000	1,780,000	1,780,000	1,780,000	2,100,000	2,548,000	2,548,000	2,548,000	2,548,000	N/A

Model – 6

Safe use of agro chemical usage to minimize environmental hazards

3.6.1-Objectives

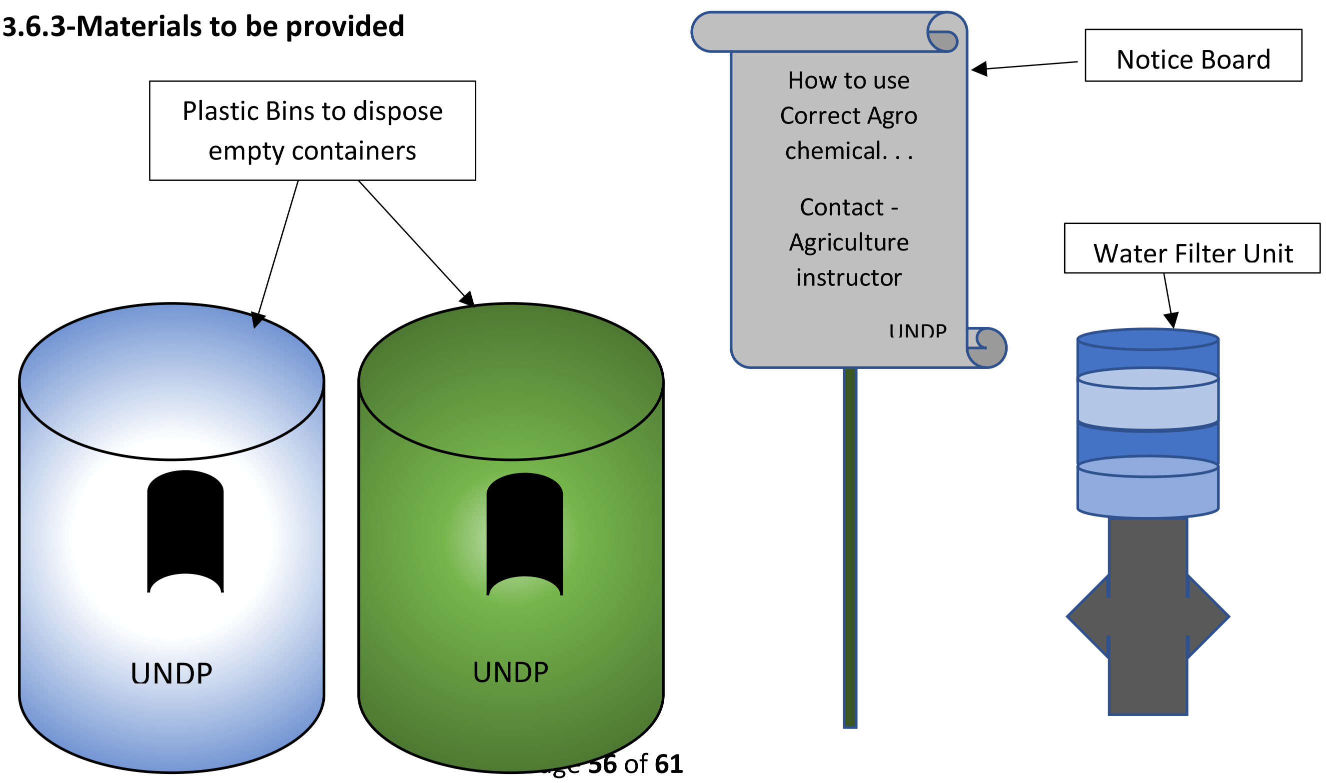
- To minimize excess usage of fertilizer and pesticides and persuade farmers to switch to DOA recommendations.
- Farmers will be made aware of selection of most appropriate pesticides for a certain crop and always it should be from the DOA recommended list
- To check environmental hazards from empty pesticide containers by introducing exact disposal methods.
-

3.6.2-Activities. . .

- Providing bins for safe disposal of empty containers and fixing notice boards to make aware of proper usage of agro chemicals.
- Providing water filter unit to filter the water to dilute agro chemicals. This will helps to get maximum efficiency of chemical and reduce excess usage.
- Establishing a committee including farmers, Agro chemical dealers and government officers to monitor the activity.
- Linking with "crop life", the national body engaged in agrochemical sector and draw up a practical action plan for safe disposal and correct use of agro chemicals disposing.
- School awareness program.
- Incentives for spray men and empty container collectors.

3.6.3-Materials to be provided

3.6.3-Materials to be provided



3.6.4-Estimate for the Model-6

Item	NO	Cost (Rs)
Officer Training Workshop	50 officers	25,000.00
Farmer training in a Yaya	75 farmers	25,000.00
Purchase of Plastic Barrels	30 Nos	60,000.00
Purchasing of safe sparaying kits	75 nos	75,000.00
Handout and posters		40,000.00
0.25 c. meter barrels with feeding gate.	3 nos	6,000.00
Primary sand and charcoal filter unit with feeding gate	1	5,000.00
Total		236,000.00

Chapter 4-

4.1-Summary of the model types, number of replicates proposed by two provincial departments.

Model	Tentative estimate /model (Rs)	Puttalam	Anuradapura	Total cost - Rs
1- Home Garden	247,000.00	5 (1Ac-4,0.5 Ac-1)	5	2,470,000.00
2-Mango cultivation with good agricultural practices	175,000.00	4	5	1,575,000.00
3-Farm Development with Rain Water harvesting	175,000.00	1	1	350,000.00
4-chena Stabilization	234,000.00	2	1	468,000.00
5-Mahaweli Paddy land Development	280,000.00	-	2	560,000.00
6-Pestcide regularization	236,000.00	4	1	1,180,000.00
Total number of replicates		16	15	6,099,000.00
Administrative charges	@9%			6,647,900.00

4.2-Approved models and number of replicates for two provincial departments.

Model	Tentative estimate /model	Anuradapura	Cost for Anuradhapura	Puttalam	Cost for Puttalam
1-Home Garden	247,000.00	4	988,000.00	3	741,000.00
2-Mango cultivation with good agricultural practices	175,000.00	3	525,000.00	4	700,000.00
3-Farm Development with Rain Water harvesting	175,000.00	1	175,000.00	1	175,000.00
4-chena Stabilization	234,000.00	1	234,000.00		
5-Mahaweli Paddy land Development	280,000.00	2	560,000.00		
6-Pestcide regularization	236,000.00	1	236,000.00	3	708,000.00
Total number of replicates		12	2,718,000.00	11	2,324,000.00
Administrative charges	@9%		244,620.00		209,160.00
Total			**2,962,620.00**		**2,533,160.00**

Chapter 5

5.1-Field establishment and monitoring process

It is strongly proposed to incorporate following process into the MOU to be signed between PDOA and UNDP.

5.1.1-Collaborative approach should be adopted to select beneficiaries

5.1.2- Strong monitoring process should be adopted. It is recommended to follow below activities to make a significant progress

A-Field establishment of a particular model should be done with direct involvement of the DOA.
B--Photo monitoring is strongly recommended and it is suggested to do it once a month
C-Record keeping must be done in accordance with the provided data sheet.

D-Improvements to bio diversity should be monitored and recorded (Indicators will be provided to a beneficiaries.)
5.1.3-Benificiary should be agreeable to continue the model for at least four seasons in his/her field .In this scenario funds will be provided for first two seasons by UNDP and subsequent seasons either the PDOA or beneficiary should be able to continue it in a sustainable manner.
5.1.4-Beneficiaries should agree to use his field as a demonstration field and must allow conducting field days with DOA.