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## Model nursery of medicinal and aromatic plants at NAU, Navsari: Initiative towards production of quality planting material & conservation of herbal resources

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### Abstract

Conservation of Medicinal and aromatic plants through nursery is one of the major promotional schemes now days promoted by National Medicinal Plant Board (NMPB) and various state medicinal plant boards. The Core of the nursery is to raise the MAPs plants from the seed and through vegetative propagation and thereby provide quality planting material to farmers, schools and common man. The rapidly depleting valuable medicinal and aromatic plants must also be preserved. So, nurseries specializing in these crops have started to thrive in order to save and multiply the precious medicinal and aromatic plants. The Ayurvedic medicinal professionals also demand these plants. Model Nursery on MAP's at Navsari Agricultural University was initiated under National Horticulture Mission. It is located in the AES zone-III (Heavy rainfall zone) with a total area of over 4 ha. In all, 117 MAPs species is conserved and multiplied by various vegetative and non-vegetative methods. Out of this 117, 49 are herb species, 21 species of shrubs, 11 species of climbers, 4 grass species and 32 tree species. Some of Medicinal plant taxa categorized as rare, endangered and threatened such as *Calophyllum inophyllum*, *Tecomella undulata*, *Rauwolfia tetraphylla*, *Costus speciosus*, *Chlorophytum borivilianum*, *Strychnos nux vomica*, *Semecarpus anacardium* and *Sterculia foetida* are also conserved in the nursery. Apart from this, nursery also harbors 3 species of genus *Asparagus*- *Asparagus racemosus*, *Asparagus sprengeri* and *Asparagus gonocladus*, 3 species of *Mentha*- *Mentha piperita*, *Mentha spicata* and *Mentha arvensis*, 2 species of *Withania*- *Withania somnifera* and *Withania coagulans* along with two varieties- Anand Ashwagandha 1 and Jawahar Ashgandh. Seeds of 97 MAPs species are collected and stored. Annually, 80,000 plant seedling and sapling are sold and more than 200 farmers and students visit the nursery. Some of the other important plant species at nursery includes red and white seeded *Abrus precatorius*, *Andrographis paniculata*, *Gloriosa superba*, *Gymnema sylvestre*, *Sida acuta*, *Sida rhombifolia*, *Piper betel*, *Plumbago zeylanica*, *Aloe vera*, *Tinospora cordifolia* and *Glycyrrhiza glabra*. The present compilation is aimed to provide the details of collection, multiplication and conservation of herbal resources at Navsari Agricultural University, Gujarat.

**Keywords:** model nursery, medicinal, conservation, rare, endangered, threatened

### 1. Introduction

Nursery is one of component/managed sites that is designed to produce seedlings grown under favourable conditions until they are ready for planting. All nurseries primarily aim to produce and provide the sufficient quantities of high-quality seedlings to satisfy the demands of user MAPs constitute a considerably large component of natural vegetation. Several of MAPs species are in great demand for domestic consumption as well as for commercial use by the herbal industry. MAPs resource pools were plethoric in forest but forest areas are destroying fast due to anthropogenic pressure. Accordingly, the elective way to create increasingly crude materials could be just through development of restorative plants in farming fields. Importance of cultivation of medicinal and aromatic plants is increasing steadily due to the side effects of chemical and artificial medicines that is creating awareness among the people worldwide. Conservation and improvement of threatened/endangered/ endemic species of medicinal and aromatic plants is becoming very important. (Devi *et. al*, 2017) [2]. The basic objectives of model nursery of MAPs are as given below:

- To provide quality and genuine planting materials to the farmers.
- To promote general awareness regarding the medicinal and aromatic plants.
- To provide Bio-resources for research in Medicinal and Aromatic Plants.
- Collection and *ex-situ* conservation of rare and endangered medicinal plants.

- To encourage growers and farmers for cultivation of medicinal plants.
- Multiplication and propagation of medicinal plants.

## 2. Material and Methods

### 2.1 Study area

Navsari Agricultural University is 3.2 km away from Navsari Railway station. The Model Nursery of MAP's established at Navsari Agricultural University was initiated under National Horticulture Mission and National Horticulture Board. It is located in the AES zone-III (Heavy rainfall zone) with a total area of over 4 ha. Geographically it is located 20°55'20.5"N latitude 72°54'19.2"E longitude.

### 2.2 Methodology

A preliminary check list of medicinal and aromatic plants which are suitable in the AES Zone III climatic conditions was furnished initially in consultation with field experts. Accordingly, the list was further bifurcated into collections that can be procured from surrounding regions and also to be availed from other sources, such as private nurseries, DMAPR, Boriavi centre, Anand Agricultural University and also from farmer's field. Initial phase of the nursery establishment was to build up demonstration plots, net house and poly house. The second and third phase focused more on establishment of seedlings and saplings, along with the seed collections. Nursery also aims to conserve RET species, the list of which is provided in results and discussion part.

## 3. Results and Discussion

Model Nursery on MAP's has total of 117 MAPs species that are conserved and multiplied by various vegetative and non-vegetative methods. Out of this 117, 49 are herb species, 21

species of shrubs, 11 species of climbers, 4 grass species and 32 tree species. Annually, 80,000 plant seedling and sapling are sold and more than 200 farmers and students visit the nursery. The total MAPs in (Table 1) are alphabetically arranged as per their botanical names followed by the English name, family, part used and uses. This detailed have been written as per Wealth of India, CSIR, New Delhi (1985, 11 volumes) <sup>[10]</sup>, Kirtikar, K. R and B. D. Basu (1991, 2<sup>nd</sup> reprinted edition, Vol. I to VIII), Farooqi A. A. and B. S. Sreeranu (2001) <sup>[3]</sup>, Deshpande, D. J. (2005) <sup>[1]</sup>, Khare, C. P. (2007), Kurain and Asha Sankar (2007) <sup>[6]</sup>, Trivedi, P. C. (2009-10) <sup>[9]</sup> and Sharma, R. (2013) <sup>[7]</sup>. The rare and endangered species has been referred through [http://bsienvis.nic.in/Database/t\\_3942.aspx](http://bsienvis.nic.in/Database/t_3942.aspx). Maximum plant parts used are roots and tubers followed by leaves, seed and whole plants. Seed husk of a single plant used for medicinal purpose which is followed by gum and flowers (Fig 1). Model Nursery of MAP's is having biodiversity constituting 49 herbs, 32 trees, 21 shrubs, 11 Climbers and 4 grass species in total (Fig 2). List of RET species is mentioned in (Table 2). Nursery produce 97 seeds of different species for propagation, nursery research of students and sale for the framers demanded (Table 3). There is total 54 Plant families in which the maximum plant species found in Fabaceae (8), Caesalpiaceae (8) followed by Apocynaceae (7), Asclepiaceae (5), Liliaceae (5) and Solanaceae (5), respectively. Varieties and unique species of MAP's collected from other states are given in (Table 4). Plant propagation is carried out through both vegetative and non-vegetative methods. Maximum plant propagation has been done through the seeds followed by cuttings, seeds and cuttings, seeds and tubers. (Table 5).

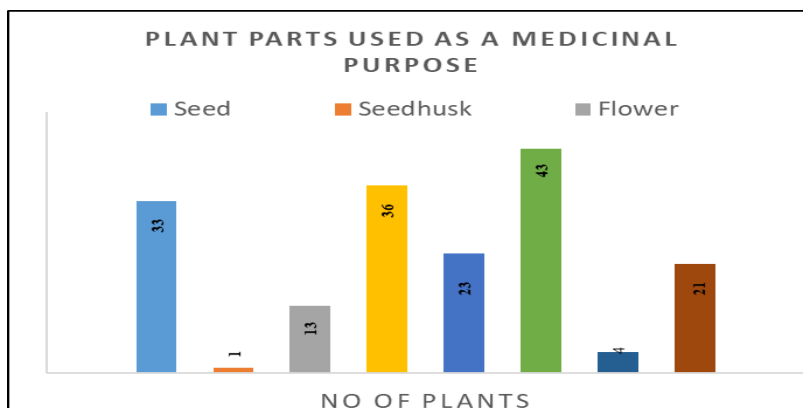


Fig 1: MAPs according to the usable plant parts at model nursery, NAU, Navsari

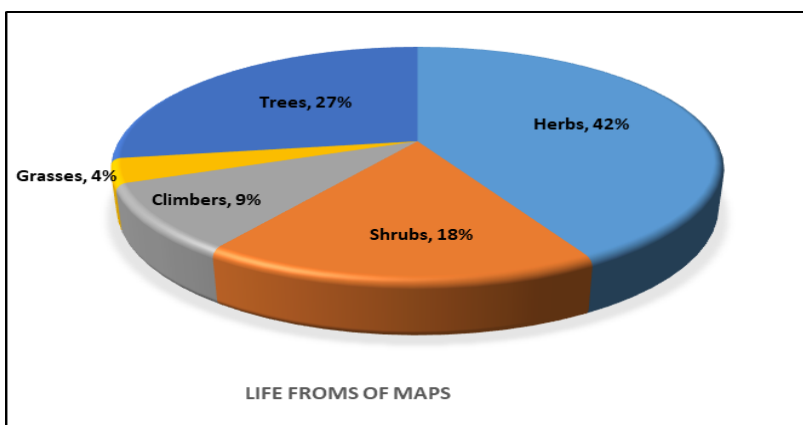


Fig 2: Plant forms found in Model Nursery of Medicinal and Aromatic Plants at NAU, Navsari

**Table 1:** Medicinal Plants at Model Nursery of NAU, Navsari

#	Botanical Name	English Name	Family	Part used	Uses
1	<i>Abelmoschus moschatus</i> (Linn.) Moench.	Kasturi Bhindi	Malvaceae	Fruit pod, Seeds	Decoction, emollient, demulcent, diuretic, catarrhal affections, ardor urine, dysuria, dysentery and antispasmodic.
2	<i>Abrus precatorius</i> Linn.	Indian Liquorice	Papilionaceae	Roots, leaves and seeds	Nervous debility, leukoderma, alopecia, sciatica, stiff joints, paralysis and obstinate cough.
3	<i>Abutilon indicum</i> Linn. Sweet.	Country Mallow	Malvaceae	Leaves, roots and seeds	Urinary trouble, lumbago, diuretic, nervous tonic, anti-pyretic, dyspepsia, general debility, piles, leucorrhoea and tuberculosis.
4	<i>Acacia catechu</i> (Linn. f.) Willd.	Cutch Tree	Mimosaceae	Barks and heart wood	Melancholia, conjunctivitis, cough, catarrh, skin diseases, diarrhoea, dysentery, haemorrhages and splenomegaly,
5	<i>Acacia nilotica</i> (L.) Willd. ex Delile	Babul	Mimosaceae	Barks, gum, flowers and pods	Cough, biliousness, bleeding, diarrhoea & dysentery
6	<i>Achyranthes aspera</i> Linn.	Prickly Chaff Flower	Amaranthaceae	Whole plant, roots and seeds	Cough, bronchitis, dyspepsia, dropsy, vomiting, skin diseases,
7	<i>Aconitum heterophyllum</i> Wall. ex Royle.	Indian Atees	Ranunculaceae	Roots	Appetizer, astringent, carminative, diarrhoea, dysentery, gastric pain,
8	<i>Aegle marmelos</i> (L.) Correa ex Roxb.	Bael Tree	Rutaceae	Leaves, mature fruit, and bark	Diabetes, digestive and stomachic parts,
9	<i>Albizia lebbek</i> (L.) Benth.	Lebbek	Mimosaceae	Flowers, seeds and barks	Anabolic, for muscular development in thin and weak persons, scrofula, eye drops, anti inflammatory and wound healer.
10	<i>Allium schoenoprasum</i> Linn.	Chives	Liliaceae	Bulbs, leaves and seeds	Haemoptysis, epistaxis, cough, sore throat, asthma, haematometra, dyspepsia, dysentery and oxyuria.
11	<i>Aloe vera</i> (L.) Burm.f.	Indian Aloe	Liliaceae	Leaves	Cosmetics, glycosides anti-irritant, anti-aging, soothing, laxative, wound healing, skin burns and care, ulcer and jaundice.
12	<i>Alstonia scholaris</i> R. Br.	Dita Bark	Apocynaceae	Barks	Fever, malaria fevers, diarrhoea, dysentery, skin diseases, tumors, ulcer, asthma and helminthiasis
13	<i>Amomum subulatum</i> Roxb.	Larger Cardamom	Scitamineae	Seeds	Halitosis, anorexia, dysentery, skin diseases, pruritus, wounds, ulcers, cephalgia
14	<i>Amorphophallus campanulatus</i> (Roxb.) Blume ex Decne.	Elephant Foot Yam	Araceae	Corms	Food, medicine, bronchitis, arthralgia, asthma, anorexia, elephantiasis, tumors, flatulence, colic
15	<i>Andrographis paniculata</i> Wall. ex Nees	The Creat	Acanthaceae	Whole plant	Liver tonic, stomachic, chronic fever, asthma, anticancer, weakness and release of gas.
16	<i>Argyrea nervosa</i> (Burm. f.) Boj.	Elephant Creeper	Convolvulaceae	Roots	Cough, rheumatism, bronchitis, constipation and nervous weakness.
17	<i>Aristolochia indica</i> Linn.	Indian Birthwort	Aristolochiaceae	Root and leaves	Fevers, venomous insect bites and blood complaints.
18	<i>Asparagus racemosus</i> willd.	Asparagus	Liliaceae	Root powder and tuber	Antiseptic, digestive, tonic, enhance lactation, general weakness, fatigue, cough
19	<i>Azadirachta indica</i> A. Juss.	Neem Tree	Meliaceae	Leaves, flower, bark, oil and fruit	Skin diseases, pimple, anti-diabetes, anti-viral, toothache, sedative, analgesic
20	<i>Bacopa monnieri</i> (Linn.) Penn.	Thyme Leaved Gratiola	Scrophulariaceae	Whole plant	Brain tonic
21	<i>Balanites aegyptiaca</i> (Linn.) Delile	Ingario	Balanitaceae	Fruit, leave pulp and seeds	Purgative, anthelmintic, burns, cough, colic, hypotensive and soap making.
22	<i>Bauhinia racemosa</i> Lamk	Bidi Leaf Tree	Caesalpiniaceae	Gum and leaf	Malaria, dysentery, diarrhoea and fever.
23	<i>Biophytum sensitivum</i> (Linn.) DC.	Lajoni, Jhalai, Lakajana	Oxalidaceae	Whole plant and leaves	Insomnia, convulsions, cramps, chest-complaints
24	<i>Boerhavia diffusa</i> Linn.	Spreading Hogweed	Nyctaginaceae	Whole plant	Asthma, jaundice, fever, inflammation, urinary tract, strangury, leucorrhoea
25	<i>Bombax ceiba</i> Linn.	Silk Cotton Tree	Bombacaceae	Roots and gum	Tonic, dysentery, astringent, stimulant, aphrodisiac
26	<i>Boswellia serrata</i> Roxb.	Boswellia	Burseraceae	Bark, gum	Arthritis.
27	<i>Bryophyllum calycinum</i> Salisb.	Airplant	Crassulaceae	Leaves	Vomiting of blood, menorrhagia, diarrhoea, dysentery, acute inflammation and fresh wound.
28	<i>Butea monosperma</i> (Lam.) Taub.	Flame of the Forest	Fabaceae	Gum and seeds	Astringent, internal bleeding and ringworms
29	<i>Calotropis procera</i> (Ait.) R.Br.	Swallow Wort	Asclepiadaceae	Dried whole plant and flower	Tonic, expectorant, anthelmintic, digestive, stomachic and tonic.
30	<i>Carissa congesta</i> Wight	Karanda	Apocynaceae	Roots, fruits and	Diarrhoea, anorexia, intermittent fevers

				leaves	
31	<i>Cassia angustifolia</i> Vahl.	Tinnavelly Senna	Caesalpiniaceae	Whole plant	Laxative and purgative, intestinal worms
32	<i>Cassia auriculata</i> Linn.	Tanners Cassia	Caesalpiniaceae	Roots, barks, leaves, flowers and seeds	Skin diseases, leprosy, asthma
33	<i>Cassia fistula</i> Linn.	Golden Shower	Caesalpiniaceae	Roots, leaves, bark, and fruit pulp	Purgative, laxative and skin diseases.
34	<i>Cassia occidentalis</i> Linn.	Negro Coffee	Caesalpiniaceae	Roots, leaves and seeds	Purgative, expectorant, febrifuge, inflammation, diabetes
35	<i>Cassia tora</i> Linn.	Foetid Cassia	Caesalpiniaceae	Leaves and seeds	Laxative, liver tonic, wormicide, carditonic, ringworm
36	<i>Catharanthus roseus</i> (L.) G. Don.	Periwinkle	Apocynaceae	Whole plant	Hypertensive, sedative, tranquilising, toxic, bitter, acrid, stomachic
37	<i>Catunaregam spinosa</i> (Thunb.) Tirveng.	Emetic Nut	Rubiaceae	Fruits	<i>Kapha &amp; Vata</i> , vomiting.
38	<i>Centella asiatica</i> (Linn.) Urban.	Indian Penny Wort	Apiaceae	Whole plant	Memory enhancer
39	<i>Chlorophytum borivilianum</i> Linn.	Indian Spider Plant	Liliaceae	Roots	Rheumatic and nervous complaints.
40	<i>Citrullus colocynthis</i> Schrad.	Colocynth	Cucurbitaceae	Fruits and root	Rheumatism and urinary troubles
41	<i>Citrus medica</i> Linn.	Citron	Rutaceae	Seed, leaf and fruit	Bilious fever, dyspepsia and inflammatory affections
42	<i>Clerodendrum multiflorum</i> (Burm.f.) Kuntze	Arni	Verbenaceae	Roots and leaves	Diuretic, alternative, tonic and demulcent used in gonorrhoea.
43	<i>Coleus forskohlii</i> Briq.	Coleus	Lamiaceae	Roots	In ophthalmology for the treatment of glaucoma.
44	<i>Commiphora wightii</i> (Arn.) Bhandari.	Indian Bdellium	Burseraceae	Gum	Rheumatism
45	<i>Coriandrum sativum</i> Linn.	Coriander	Apiaceae	Fruits, seeds, and leaves	Astringent and Carminative
46	<i>Costus speciosus</i> (Koenig) Sm.	Crape Ginger	Scitamineaceae	Root stock and rhizomes	Flatulence, constipation, skin diseases, fever, bronchitis, inflammation and anaemia
47	<i>Curcuma longa</i> Linn.	Turmeric	Scitamineaceae	Rhizomes	Stomachic, laxative, cough, asthma, bronchitis, wounds, ulcers, skin diseases, leprosy, loss of appetite, flatulence, anaemia, enlargement of spleen, liver, fever, ring worm, dropsy, epilepsy and jaundice
48	<i>Cymbopogon citratus</i> (DC.) Stapf.	Lemon grass	Poaceae	Essential oil	Anti-oxidant
49	<i>Cymbopogon martinii</i> (Roxb.) Wats.	Rosha Grass	Poaceae	Essential oil	Anti-oxidant
50	<i>Cymbopogon wintrianus</i> Jowitt.	Citronella Grass	Poaceae	Essential oil	Anti-oxidant
51	<i>Dalbergia sissoo</i> Roxb ex DC.	Indian Rosewood	Fabaceae	Roots, leaves, barks and heartwood	Diarrhoea, dysentery, diuresis
52	<i>Datura innoxia</i> Mill.	Datura	Solanaceae	Root, leaves, flowers, seeds, whole plant	Parkinson's disease, skin diseases, rheumatism, headache
53	<i>Datura metel</i> Linn.	Thorn Apple	Solanaceae	Whole plant	Asthma, cough, fever, ulcers, skin diseases and antispasmodic.
54	<i>Eclipta alba</i> (Linn.) Hassk.	Bhringaraj	Asteraceae	Whole plant	Hair tonic
55	<i>Embelia ribes</i> Burm. f.	False Pepper	Myrsinaceae	Roots, leaves and fruits	Diseases of infants.
56	<i>Enicostemma hyssopifolium</i> (Willd) I. C. Verdoorn.	Indian Gentian	Gentianaceae	Panchang	Fever, sciatica, rheumatism and diabetes
57	<i>Ensete superbum</i> (Roxb.) Cheesman	Wild Banana	Musaceae	Roots and stem	Veneral diseases.
58	<i>Evolvulus alsinoides</i> Linn.	Shankhapushpi	Convolvulaceae	Whole plant and panchang	Brain tonic
59	<i>Ficus benghalensis</i> Linn.	Banyan Tree	Moraceae	Whole plant	Anti-inflammatory, pain reliever, neuralgia and rheumatism
60	<i>Ficus racemosa</i> Linn.	Cluster Tree	Moraceae	Roots, barks, leaves and fruits	Dysentery, diabetes
61	<i>Gloriosa superba</i> Linn.	Glory Lily	Liliaceae	Roots, rhizome	Inflammation, ulcers, scrofula, haemorrhoids, parasitic
62	<i>Glycyrrhiza glabra</i> Linn.	Liquorice	Fabaceae	Stems, roots	Tonic, expectorant, diuretic
63	<i>Gmelina arborea</i> Roxb.	Sivan	Verbenaceae	Root, bark and fruit	Tonic, anti-inflammatory, and dasmularista
64	<i>Gymnema sylvestre</i> B. Br.	Gymnema	Asclepiadaceae	Leaves	Anti-diabetic
65	<i>Helicteres isora</i> Linn.	East Indian	Sterculiaceae	Fruits	Dysentery



		Screw Tree			
66	<i>Hemidesmus indicus</i> (L.) R. Br.	Country Ipecac	Asclepiadaceae	Root, seed	Chronic cough, syphilitic
67	<i>Holarrhena pubescens</i> Wall. ex G. Don	Indrajao	Apocynaceae	Bark, seed	Amoebic dysentery
68	<i>Indigofera tinctoria</i> Linn.	Indigo	Febaceae	Whole plant	Natural dyes.
69	<i>Jasminum grandiflorum</i> Linn.	Spanish Jasmine	Oleaceae	Whole plant	Headache, mental debility, flatulence
70	<i>Justicia adhatoda</i> Linn.	Malbar Nut	Acanthaceae	Roots, barks and leaves	Cough, bronchitis, asthma, skin diseases, eczema and scabies.
71	<i>Lawsonia inermis</i> Linn.	Henna	Lythraceae	Leaves	Skin diseases and Hair tonic
72	<i>Leptadenia reticulata</i> W. & A.	Cork Swallowwort	Apocynaceae	Root, shoot tip, leaves,	Tonic, increases milk yield, skin diseases, leucoma
73	<i>Mentha piperata</i> Linn.	Peppermint	Lamiaceae	Leaves, flowers and oil	Astringent, Carminative & Anti - oxidant
74	<i>Millettia pinnata</i> (L.)Panigrah	Karanj	Fabaceae	Seeds, barks, roots, leaves, flowers and bark	Diabetes. bleeding piles, mental disorder, cough and cold
75	<i>Mimosa pudica</i> Linn.	Sensitive Plant	Mimosaceae	Roots, leaves and seeds	Diuretic, antispasmodic, emetic, constipating, wounds, fever, pitta, leukoderma, ulcers
76	<i>Mimusops elengi</i> Linn.	Bullet Wood Tree	Sapotaceae	Bark, fruit, flower & seed oil	stone in the bladder, fevers, tonic wounds, ulcers
77	<i>Mirabilis jalapa</i> Linn.	Four O'Clock Plant	Nyctaginaceae	Roots, flowers and leaves.	Stomach, food colouring
78	<i>Moringa oleifera</i> Lam.	Drum Stick	Moringaceae	Roots, stem bark, leaves and pods	Kapha & vata, fever, epilepsy, hysteria, chronic rheumatism
79	<i>Mucuna pruriens</i> Baker non DC.	Cowhage	Fabaceae	Seeds and roots	Anti-parkinson properties
80	<i>Nerium indicum</i> Mill.	Indian Oleander	Apocynaceae	Seeds, barks, roots, leaves and flowers	Rat poison, wounds, haemorrhoids, ulceration and skin diseases.
81	<i>Nyctanthes arbor-tristis</i> Linn.	Night Jasmine	Oleaceae	Leaves and flowers	Vata & Kapha, skin diseases, chronic fever, bronchitis, asthma, diseases of liver
82	<i>Ocimum basilicum</i> Linn.	Common sweet basol	Lamiaceae	Oil	Flavouring agent in confectionery.
83	<i>Ocimum sanctum</i> Linn.	Basil Sacred	Lamiaceae	Whole plant	Digestive, diuretic, expectorant
84	<i>Phyllanthus emblica</i> Linn.	Indian Gooseberry	Phyllanthaceae	Root, bark and fruit	Ulcer, jaundice, diabetes, asthma, skin disease, anaemia, vitamin-C
85	<i>Phyllanthus fraternus</i> Webster.	Country Gooseberry	Euphorbiaceae	Whole plant	Anaemia, jaundice, astringent
86	<i>Piper betle</i> Linn.	Betel Leaf Plant	Piperaceae	Leaves	Stimulates brain, lungs and heart.
87	<i>Piper longum</i> Linn.	Indian Long Pepper	Piperaceae	Fruits, roots and dried spikes	Diseases of spleen, gastric stimulant, aphrodisiac
88	<i>Plantago ovata</i> Forsk.	Psyllium Husk	Plantaginaceae	Seed and seed husk	Affections of kidney, bladder and urethra
89	<i>Plumbago indica</i> Linn.	Rose Leadwort	Plumbaginaceae	Root	In dyspepsia, colic, inflammation and cough.
90	<i>Plumbago zeylanica</i> Linn.	White Leadwort	Plumbaginaceae	Root	Rheumatism, paralytic affections, syphilis
91	<i>Psoralea corylifolia</i> Linn.	Babchi	Fabaceae	Seeds	Skin diseases
92	<i>Punica granatum</i> Linn.	Pomegranate	Punicaceae	Roots, barks, flowers, fruits and seeds	Diseases of heart, intestinal worms, tapeworms, dysentery, diarrhoea and stomach pains.
93	<i>Rauvolfia tetraphylla</i> Linn.	Rauvolfia	Apocynaceae	Root and leaves juice	Anti-hypertensive
94	<i>Ricinus communis</i> Linn.	Castor	Euphorbiaceae	Roots, leaves, seed oil	Rheumatism
95	<i>Santalum album</i> Linn.	Sandalwood Tree	Santalaceae	Heart wood and oil	Skin disorder, burning, sensation, jaundice, and cough.
96	<i>Sapindus laurifolius</i> Vahl.	Soapnut Tree	Sapindaceae	Root, bark and fruit	Hair tonic
97	<i>Saraca asoca</i> (Roxb.) De Wilde.	Ashoka Tree	Caesalpiniaceae	Bark	Gynaecological disorders
98	<i>Scindapsus officinalis</i> Schott.	Elephant Piper	Araceae	Barks and oil	Pruritus, adenitis, ripening boils, nostalgia
99	<i>Sida acuta</i> Burm. f.	Horn bean leaved sida	Malvaceae	Panchang	Nervous disorder and heart problems.
100	<i>Solanum nigrum</i> Linn.	Black	Solanaceae	Leaves	Kidney ailment.

		Nightshade			
101	<i>Solanum surattense</i> Burm.f.	Nightshade	Solanaceae	Whole plant, fruits and seeds	Anti-inflammatory, digestive, carminative, appetizer, stomachic
102	<i>Strychnos nux-vomica</i> Linn.	Nux Vomica	Loganiaceae	Seed	Nervous, paralysis and healing wound.
103	<i>Syzygium cuminii</i> (Linn.) Skeels.	Black Plum	Myrtaceae	Barks, leaves and fruits	Anti-diabetic & Anti-arthritis
104	<i>Tamarindus indica</i> Linn.	Tamarind	Caesalpiniaceae	Roots, leaves, fruits and seeds	Tonic, diarrhoea, asthma, ulcers, diuretic, laxative
105	<i>Tephrosia purpurea</i> (L.) Pers.	Wild Indigo	Fabaceae	Whole plant	Digestive, laxative, diuretic, anti-inflammatory, styptic, antipyretic
106	<i>Terminalia arjuna</i> (Roxb.)W. & A.	Arjuna	Combretaceae	Leaves, stem and bark	Gastric problem and heart trouble.
107	<i>Terminalia bellirica</i> Roxb.	Belliric myrobalan	Combretaceae	Bark, leaves, fruits and seed	Vomiting, loose motion, cough, insomnia, dropsy and ulcer.
108	<i>Terminalia chebula</i> Retz.	Myrobalan	Combretaceae	Fruits	Laxative, stomachic, enlarge spleen, urinary diseases, wound ulcer, leprosy, inflammation and cough.
109	<i>Thevetia peruviana</i> (Pers.) K. Schum.	Yellow oleander	Apocynaceae	Seeds	Insecticides
110	<i>Tinospora cordifolia</i> (Willd.) Miers ex Hook. f. & Thoms.	Tinospora	Menispermaceae	Stem	Gout, cardiac debility, skin diseases, anaemia, cough, asthma, general debility, seminal weakness, dyspepsia, fever, urinary diseases and antipyretic.
111	<i>Tribulus terrestris</i> Linn.	Small Caltrops	Zygophyllaceae	Fruit and whole plant	Tonic, diuretic, aphrodisiac, emollient, digestive, anthelmintic, expectorant, anti-inflammatory, laxative, cardio tonic, urinary calculi and scalding of urine.
112	<i>Trichosanthes cucumerina</i> Linn.	Snake Gourd	Cucurbitaceae	Panchang	Fever, febrifuge, laxative and disorder of stomach
113	<i>Tylophora indica</i> (Burm. f.) Merrill.	Damni Vel	Asclepiadaceae	Leaves and root	Asthma, cough, bronchitis, diarrhoea, dysentery, wounds, ulcers, cancerous, tumours, carminative, aphrodisiac and astringent.
114	<i>Vetiveria zizanioides</i> (Linn.) Nash.	Khus Khus	Poaceae	Root	Oil production, refrigerant, diuretic, digestive, carminative, stimulant, tonic, hysteria, insomnia, cardiac debility, burning sensation, skin diseases, nausea, dyspepsia, anaemia, gout and diarrhoea.
115	<i>Vitex negundo</i> Linn.	Five Leaved Chaste Tree	Verbenaceae	Roots, leaves and seeds	<i>Vata &amp; kapha</i> , intestinal worms, flatulence, indigestion, body pains, inflammations, wounds, malarial fever, headache, ear ache, colic, ulcers, dysentery, urinary tract, bronchitis and skin diseases.
116	<i>Withania somnifera</i> (Linn.) Dunal	Indian Ginseng	Solanaceae	Leaves, roots and old stem	Ulcers, nervous tension, brain tonic, hysteria, cough, dropsy, rheumatism, astringent, nerve sedative, gives glow to skin, restorative tonic, stress and nerves disorder.
117	<i>Zingiber officinale</i> Rosc.	Ginger	Scitaminaceae	Dry rhizomes	Flatulence, indigestion, laxative, anodyne, aphrodisiac, dropsy, ear ache, head ache, cough, asthma, colic, diarrhea, vomiting.

**Table 2:** RET species conserved at MAP's Nursery, NAU, Navsari

#	Rare and Endangered Plants	Family	English Name
1.	<i>Bauhinia foveolata</i> Dalzell	Caesalpiniaceae	Pore Leaved Tree
2.	<i>Bombax insigne</i> Wall.	Bombacaceae	Showy Silk Cotton Tree
3.	<i>Calophyllum inophyllum</i> Willd.	Calophyllaceae/Guttiferae	Indian laurel
4.	<i>Chlorophyllum borivilianum</i> Linn.	Asparagaceae	Safed musli
5.	<i>Commiphora wightii</i> (Arn.) Bhand.	Burseraceae	Indian Bedellium
6.	<i>Costus speciosus</i> Koen.	Costaceae	Crepe ginger
7.	<i>Dillenia pentagyna</i> Roxb.	Dilleniaceae	Karmal or Dog teak
8.	<i>Ensete superbum</i> (Roxb.) Cheesman	Musaceae	Rock banana
9.	<i>Ficus arnottiana</i> Miq.	Moraceae	Indian rock fig
10.	<i>Gloriosa superba</i> Linn.	Liliaceae	Glory lily
11.	<i>Oroxylum indicum</i> L. Kurz	Bignoniaceae	Indian trumpet flower
12.	<i>Rauwolfia tetraphylla</i> Linn.	Apocynaceae	Snake Root
13.	<i>Semecarpus anacardium</i> Linn.	Anacardiaceae	Indian marking nut tree
14.	<i>Sterculia foetida</i> Linn.	Sterculiaceae	Indian Almond
15.	<i>Sterculia guttata</i> Roxb.	Sterculiaceae	Spotted sterculia
16.	<i>Sterculia urens</i> Roxb.	Sterculiaceae	Indian gum tragacanth
17.	<i>Stereospermum personatum</i> (Hassk.) Chatterj	Bignoniaceae	Yellow Snake Tree
18.	<i>Strychnos nux vomica</i> Linn.	Loganiaceae	Poison Nut
19.	<i>Tecomella undulata</i> (Sm.) Seem.	Bignoniaceae	Desert Teak
20.	<i>Terminalia arjuna</i> (Roxb.) Wight & Arn.	Combretaceae	Arjun Sadad

**Table 3:** Seed Collections at MAP's Nursery, NAU, Navsari

#	Botanical Name	Local Name	#	Botanical Name	Local Name
1	<i>Abelmoschus moschatus</i> (Linn.) Moench.	Kasturi Bhindi	50	<i>Indigofera tinctoria</i> Linn.	Gadi
2	<i>Abrus precatorius</i> Linn. (Red)	Kali Chanothi	51	<i>Lepidium sativum</i> Linn.	Asadiyo
3	<i>Abrus precatorius</i> Linn. (White)	Lal Chanothi	52	<i>Linum usitatissimum</i> Linn.	Aadsi
4	<i>Abrus precatorius</i> Linn. (Black)	Safed Chanothi	53	<i>Madhuca indica</i> (L.) J. F. Macbr.	Mahudo
5	<i>Abutilon indicum</i> (Linn.) Sweet.	Kaski	54	<i>Melochia cordata</i> Burm. f.	Bala
6	<i>Achyranthes aspera</i> Linn.	Aghedo	55	<i>Millettia pinnata</i> (L.) Panigrah	Karanj
7	<i>Adenanthera pavonina</i> Linn.	Ratangunj	56	<i>Mimosa pudica</i> Linn.	Lajamani
8	<i>Aegle marmelos</i> (Linn.) Corr.	Bili	57	<i>Mimusops elengii</i> Linn.	Borsalli
9	<i>Amaranthus viridis</i> Linn.	Tandelja ni Bhaji	58	<i>Mirabilis jalapa</i> Linn.	Gulbas
10	<i>Andrographis paniculata</i> Nees.	Kalmegh, Kariyatu	59	<i>Morinda citrifolia</i> Linn.	Noni
11	<i>Anethum graveolens</i> Linn. var. sowa Roxb.	Suwa	60	<i>Mucuna pruriens</i> (L.) DC. (Black)	Kawanch, Kauncha
12	<i>Annona muricata</i> Linn.	Ramphal	61	<i>Mucuna pruriens</i> (L.) DC. (white)	Kawanch, Kauncha
13	<i>Annona squamosa</i> Linn.	Sitaphal	62	<i>Ocimum bascillicum</i> Linn.	Damro, Shyamtulsi
14	<i>Argyreia speciosa</i> (Linn. f.) Sweet	Samudra sosh, Vardharo	63	<i>Ocimum gratissimum</i> Linn.	Clove tulsi, Laving tulsi
15	<i>Asparagus racemosus</i> Willd.	Shatavari	64	<i>Ocimum kilimandsjaricum</i> Linn.	Haridwar Tulsi
16	<i>Asparagus sprengeri</i> Linn.	Ubhi shatavari	65	<i>Ocimum sanctum</i> Linn.	Lili tulsi, Ram tulsi
17	<i>Azadirachta indica</i> A. Juss.	Nimdo, Neem	66	<i>Oroxylum indicum</i> (Linn.) Vent.	Tetu
18	<i>Barleria prionitis</i> Linn.	Kanta sheriyo	67	<i>Piper longum</i> Linn.	Lindi pepper
19	<i>Bixa orellana</i> Linn.	Sindhurio	68	<i>Piper nigrum</i> Linn.	Kadamari
20	<i>Blumea lacera</i> (Burm.f.) DC. / <i>Blumea mollis</i> (D. Don) Merr.	Kalhar	69	<i>Plumbago zeylanica</i> Linn.	Chitrak
21	<i>Boerhaavia diffusa</i> Linn.	Satodi, Punarnava	70	<i>Psidium guajava</i> Linn.	Jamphal
22	<i>Bombax insigne</i> Wall.	Shimal	71	<i>Psoralea corylifolia</i> Linn.	Bavchi
23	<i>Bombax ceiba</i> Linn.	Simdo, Shemal	72	<i>Putranjiva roxburghii</i> Wall.	Putranjiva
24	<i>Brassica juncea</i> (L.) Czern.	Rai	73	<i>Rauwolfia tetraphylla</i> Linn.	Sarpagandha
25	<i>Buchanania lanzan</i> Spreng.	Charoli	74	<i>Sapindus laurifolius</i> Linn.	Aritha
26	<i>Caesalpinia crista</i> Linn. / <i>C. bonduc</i> (Linn.) Roxb.	Kachka	75	<i>Saraca asoca</i> (Roxb.) De Wilde	Ashoka
27	<i>Canavalia gladiata</i> (Jacq.) DC.	Abba	76	<i>Semecarpus anacardium</i> L. f.	Bhilamo
28	<i>Cassia auriculata</i> Linn.	Avad, Mindhi aval	77	<i>Sida ovata</i> Forssk.	Bhoy bala
29	<i>Cassia fistula</i> Linn.	Garmalo	78	<i>Solanum albicaulis</i> Kotschy ex Dunal.	Jangli ringan
30	<i>Cassia sophera</i> Linn.	Kashandro	79	<i>Solanum indicum</i> Linn.	Ubhi bhoi ringni
31	<i>Cassia tora</i> Linn.	Kuvadiao	80	<i>Solanum xanthocarpum</i> Schrad. & Wendl	Bhoi ringni
32	<i>Catharanthus roseus</i> (Linn.) G. Don	Barmasi, Sadabahar	81	<i>Sphaeranthus indicus</i> Linn.	Gorakhmundi
33	<i>Catunaregam spinosa</i> (Thunb.) Tirveng.	Mindhal	82	<i>Sterculia foetida</i> Linn.	Jungli Badam
34	<i>Celastrus paniculatus</i> Wild	Malkagni	83	<i>Stereospermum personatum</i> (Hassk.) Chatterj	Patla
35	<i>Celosia argentea</i> Linn.	Lampdi	84	<i>Syzygium cumini</i> (Linn.) Skeels	Jambu
36	<i>Chenopodium album</i> Linn.	Poi	85	<i>Tagetes patula</i> Linn.	Galgotta
37	<i>Cleistanthus collinus</i> (Roxb.) Benth. ex Hook.f.	Gareri	86	<i>Tecomella undulata</i> (Sm.) Seem.	Ragat Rohido
38	<i>Clitoria ternatea</i> Linn. (Blue)	Bhuri Vishnukanta	87	<i>Tephrosia purpurea</i> Pers.	Sarpankho
39	<i>Clitoria ternatea</i> Linn. (White)	Safed Vishnukanta	88	<i>Terminalia arjuna</i> Wt. & Arn.	Arjun sadad
40	<i>Coleus aromaticus</i> Benth.	Garmar, Garmar	89	<i>Terminalia bellerica</i> (Gaertn.) Roxb.	Behda
41	<i>Couroupita guianensis</i> Aubl.	Kailashpati	90	<i>Terminalia catappa</i> Linn.	Desi Badam
42	<i>Desmodium gangeticum</i> (L.) DC.	Shalparni	91	<i>Terminalia chebula</i> Retz.	Harde
43	<i>Datura ferox</i> Linn.	Kalo Dhanturo	92	<i>Trigonella foenum graecum</i> Linn.	Methi
44	<i>Datura metel</i> Linn.	Dhanturo	93	<i>Uraria picta</i> Desv.	Prusthparni
45	<i>Diospyros melanoxylon</i> Roxb.	Timru, Tendu	94	<i>Vernonia anthelmintica</i> L. Willd.	Kali jiri
46	<i>Eclipta alba</i> Linn.	Bhangro	95	<i>Vitex negundo</i> Linn.	Nagod, Nirgundi
47	<i>Gloriosa superba</i> Linn.	Dudhio Vachhanag	96	<i>Whithania somnifera</i> (Linn.) Dunal	Asgangh, Ashwagandha
48	<i>Gmelina arborea</i> Roxb.	Sevan	97	<i>Withania coagulans</i> (Stocks) Dunal.	Paneer doli
49	<i>Hygrophila spinosa</i> T. Anders	Aekhro, Akkalgaro			

**Table 4:** List of Species and Varieties found Model Nursery of Medicinal and Aromatic Plants at NAU, Navsari

Plant Name	#	Species	Variety
Asparagus	1.	<i>Asparagus racemosus</i> Willd.	-----
	2.	<i>Asparagus sprengeri</i> Linn.	-----
	3.	<i>Asparagus gonocladus</i> Baker	-----
Mentha	1.	<i>Mentha piperita</i> Linn.	-----
	2.	<i>Mentha spicata</i> Linn.	-----
	3.	<i>Mentha arvensis</i> Linn.	-----
Plumbago	1.	<i>Plumbago indica</i> Linn.	-----
	2.	<i>Plumbago zeylanica</i> Linn.	-----
Withania	1.	<i>Withania somnifera</i> (L.) Dunal.	1. Anand Ashwagandha I 2. Jawahar Ashgandh
	2.	<i>Withania coagulans</i> (Stocks) Dunal.	-----
Ocimum	1..	<i>Ocimum basilicum</i> Linn.	-----
	2.	<i>Ocimum sanctum</i> Linn.	-----
	3.	<i>Ocimum americanum</i> Linn.	-----
	4.	<i>Ocimum canum</i> Sims.	-----
	5.	<i>Ocimum gratissimum</i> Linn.	-----

**Table 5:** Plant Propagation Methods used in the Model Nursery of Medicinal and Aromatic Plants at NAU, Navsari

Propagations	Plant Name
Cuttings	<i>Justicia adhatoda</i> Linn., <i>Bacopa monnieri</i> (Linn.) Penn., <i>Ficus bengalensis</i> Linn., <i>Ficus racemosa</i> Linn., <i>Hemidesmus indicus</i> (L.) R. Br., <i>Indigofera tinctoria</i> Linn., <i>Jasminum grandiflorum</i> Linn., <i>Lawsonia inermis</i> Linn., <i>Leptadenia reticulata</i> W. & A., <i>Mentha piperata</i> Linn., <i>Moringa oleifera</i> Lam., <i>Piper betle</i> Linn., <i>Piper longum</i> Linn., <i>Plumbago indica</i> Linn., <i>Plumbago zeylanica</i> Linn., <i>Scindapsus officinalis</i> Schott., <i>Tinospora cordifolia</i> (Willd.) Miers ex Hook. f. & Thoms.
Seeds and stolons	<i>Glycyrrhiza glabra</i> Linn. and <i>Bryophyllum calycinum</i> Salisb.
Leaf cuttings (Buds)	<i>Bryophyllum calycinum</i> Salisb.
Root suckers	<i>Centella asiatica</i> (Linn.) Urban. and <i>Aloe vera</i> (L.) Burm.f.
Rhizomes	<i>Amomum subulatum</i> Roxb.
Seeds	<i>Abrus precatorius</i> Linn., <i>Abutilon indicum</i> Linn. Sweet., <i>Acacia catechu</i> (Linn. f.) Willd., <i>Acacia nilotica</i> (L.) Willd. ex Delile, <i>Achyranthes aspera</i> Linn., <i>Aconitum heterophyllum</i> Wall. ex Royle., <i>Aegle marmelos</i> (L.) Correa ex Roxb., <i>Allium schoenoprasum</i> Linn., <i>Andrographis paniculata</i> Wall. ex Nees, <i>Aristolochia indica</i> Linn., <i>Asparagus racemosus</i> willd., <i>Azadirachta indica</i> A. Juss., <i>Balanites aegyptiaca</i> (Linn.) Delile, <i>Bauhinia racemosa</i> Lamk, <i>Biophytum sensitivum</i> (Linn.) DC., <i>Cassia angustifolia</i> Vahl., <i>Cassia auriculata</i> Linn., <i>Cassia fistula</i> Linn., <i>Cassia occidentalis</i> Linn., <i>Cassia tora</i> Linn., <i>Catharanthus roseus</i> (L.) G. Don., <i>Citrullus colocynthis</i> Schrad., <i>Citrus medica</i> Linn., <i>Clerodendrum multiflorum</i> (Burm.f.) Kuntze, <i>Coriandrum sativum</i> Linn., <i>Cymbopogon citratus</i> (DC.) Stapf., <i>Cymbopogon martinii</i> (Roxb.) Wats., <i>Cymbopogon wintrianus</i> , <i>Dalbergia sissoo</i> Roxb ex DC., <i>Datura innoxia</i> Mill., <i>Datura metel</i> Linn., <i>Milletia pinnata</i> (L.) Panigrah, <i>Eclipta alba</i> (Linn.) Hassk., <i>Embelia ribes</i> Burm. f., <i>Phyllanthus emblica</i> Linn., <i>Enicostemma hyssopifolium</i> (Willd) I. C. Verdoorn., <i>Evolvulus alsinoides</i> Linn., <i>Helicteres isora</i> Linn., <i>Holarrhena pubescens</i> Wall. ex G. Don, <i>Mimosa pudica</i> Linn., <i>Mimusops elengi</i> Linn., <i>Mirabilis jalapa</i> Linn., <i>Mucuna pruriens</i> Baker non-DC., <i>Nerium indicum</i> Mill., <i>Ocimum basilicum</i> Linn., <i>Ocimum sanctum</i> Linn., <i>Abelmoschus moschatus</i> (Linn.) Moench., <i>Phyllanthus fraternus</i> Webster., <i>Plantago ovata</i> Forsk., <i>Psoralea corylifolia</i> Linn., <i>Rauwolfia tetraphylla</i> Linn., <i>Ricinus communis</i> Linn., <i>Santalum album</i> Linn., <i>Sapindus laurifolius</i> Vahl., <i>Saraca asoca</i> (Roxb.) De Wilde., <i>Sida acuta</i> Burm. f., <i>Solanum nigrum</i> Linn., <i>Solanum surattense</i> Burm.f., <i>Strychnos nux-vomica</i> Linn., <i>Syzygium cuminii</i> (Linn.) Skeels., <i>Tamarindus indica</i> Linn., <i>Tephrosia purpurea</i> (L.) Pers., <i>Terminalia arjuna</i> (Roxb.) W. & A., <i>Terminalia bellirica</i> Roxb., <i>Terminalia chebula</i> Retz., <i>Tribulus terrestris</i> Linn., <i>Trichosanthes cucumerina</i> Linn., <i>Vetiveria zizanioides</i> (Linn.) Nash., <i>Withania somnifera</i> (Linn.) Dunal, <i>Catunaregam spinosa</i> (Thunb.) Tirveng. Keay.
Seeds and cuttings	<i>Albizia lebbek</i> (L.) Benth., <i>Alstonia scholaris</i> R. Br., <i>Argyrea nervosa</i> (Burm. f.) Boj., <i>Boerhavia diffusa</i> Linn., <i>Bombax ceiba</i> Linn., <i>Boswellia serrata</i> Roxb., <i>Butea monosperma</i> (Lam.) Taub., <i>Calotropis procera</i> (Ait.) R.Br., <i>Carissa congesta</i> Wight, <i>Coleus forskohlii</i> Briq., <i>Commiphora wightii</i> (Arn.) Bhandari., <i>Gmelina arborea</i> Roxb., <i>Gymnema sylvestre</i> B. Br., <i>Nyctanthes arbor-tristis</i> Linn., <i>Punica granatum</i> Linn., <i>Thevetia peruviana</i> (Pers.) K. Schum., <i>Tylophora indica</i> (Burm. f.) Merrill., <i>Vitex negundo</i> Linn.
Seeds and tubers	<i>Chlorophytum borivilianum</i> Linn., <i>Costus speciosus</i> (Koenig) Sm., <i>Curcuma longa</i> Linn., <i>Ensete superbum</i> (Roxb.) Cheesman, <i>Gloriosa superba</i> Linn.
Tuber	<i>Amorphophallus campanulatus</i> Roxb. Blume ex Decne. and <i>Zingiber officinale</i> Rosc.

#### 4. Conclusions

On farm conservation, a form of ex-situ conservation is becoming an essential criterion for sustainable use of Bioresources. Such bioresources can be future utilized for bioprospecting considering future demands. MAP's from time immemorial are integral part of human culture and *Materia medica*. MAP's nursery at NAU, Navsari aim at propagation supply and conservation with total collection of more than 100 species also seed collection and storage of 97 species. Nursery also supplies sapling and seedling of MAP's on

regular basis. Some of important RET plants are also conserved at Nursery. Germplasm and accessions collections of *Mentha*, *Gloriosa*, *Caesalpinia*, *Tinospora*, *Ocimum* and *Asparagus* are also maintained. There is future/further plan to make digital database of plants, that can be utilized by farmers, students, MAP's grower and traders.

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