Quality seedling production through protray nursery

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Abstract:-

In modern period soilless growing media is the most effective and scientific method for quality seedling development. Healthy seedling is the primary factor for increase yield, doubling farmer's income and prevents starvation. Soilless growing media with portray nursery is the one and only process for quality seedling produce because; less chance attack microbes and irrigation, pH level, EC level properly controlled by artificially. Vegetable and Flower seedling basically grown under this method because, both crops are highly sensitive with fungi, bacteria, nematode, pest and this two crops has more demand in the market. Different types growing media use with portray nursery such as; cocopeat, vermiculite, perlite, sphagnum moss, bark, saw dust, rock wool, sand and rice husk also. Before using growing media should be sterilized because; in this process all types bacteria, fungi, nematode, pest, weed seed and virus also killed. Soil sterilization also various types such as; solar sterilization, chemical sterilization, steam sterilization, Fumigation also applicable but many beneficial microbes also killed through this process and other side sterilization process also hazard for human and soil health. Portray nursery are lighter weight so, easily movement here and there according to necessary of farmers requirement and this process seedling germination rate greater than traditional method.

Key words:- Portray nursery, Soilless media, sterilization, Seedling

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Introduction:-

The healthy seedling is the most important factor for getting higher yield and quality of any crops but portray nursery method widely used for flower and vegetable crops because; both this crop has huge potential power to increase income per unit area of farmers (Bharathi *et al.,* 2014). We are widely used for commercially cultivation of cut flowers like chrysanthemum, rose **(**Hazar and Baktir, 2013), gerbera (Şirin, 2011), blooming bulbous plants like yellow crocus (*Sternbergia lutea)* (Kahraman, 2014), lily, tulip, potted ornamental plants like anthurium

(Dufour and Guerin, 2005), rubber, cyclamen and vegetable crops like chilli, Tomato, lettuce crops better performance in this method (Adediran, 2005). Farmers produced seedling on the field or under protected condition but growing media as a soil. Soil is the major source of micro-organism so, seedling has more chance to attack when seedling growing on the soil. Now a day's naturally vegetable crops and flower crops seedling are highly sensitive so, easily attack micro-organism and under seedling condition such as; down mildew, damping off, seedling blight, viral diseases, panicle disease, root rot disease can be found. To avoid these types of disease infestation, pro tray nursery with soilless growing media are the most suitable method for quality seedling production. Modern technology (portray nursery+soilless growing media+high yielding variety) are most important for fulfill our daily requirement because, the population of the country is constantly increasing day after day.

Pro tray basically made by plastic where different circular and rectangular shape block are found but, rectangular shape are most suitable due to large space for proper growth of the seedling root. Pro tray nursery basically setup under shade net or poly house but has recently been used in open field conditions (Hazar and Baktır, 2013). For tomato, chilli, brinjal and other types of vine vegetable use pro-trays having block of (1-1.5)m; 2 dimensions and capsicum, cauliflower, aster, marigold, zinnia, petunia havings blocks of (1.0-1.5)m; 2 dimensions (Reddy, 2019).

Advantage of pro tray nursery:-

- If seed sowing under portray nursery so, 100% germination of seed
- Seed sowing cost very less compared with raising nursery in field
- No require plowing for seed sowing under pro tray
- Nursery is less maintained
- Very less chance attack soil born disease and pest
- Easily transferable this type nursery.
- This method no problem of root breakage while taking out the plants for transplanting in the main field.
- Extend the growing season
- Use expensive hybrid seeds more efficiently
- Predict the harvest date more accurately

Dis-advantage of pro tray nursery: –

- Cost effective when first time farmer purchases
- Proper knowledgeable person require for handle

- Limited nutrient plant uptake through growing media under this technology

Saline feature of growing media:-

We know that soil is the primary growing media for seedling preparation but, it has major source of soil born micro-organism attack during seedling condition. Behind this region pro tray nursery with soil less growing media most scientific and successful method for quality seedling production. Different types growing media are cocopeat, vermi-compost, sphagnum moss, elite, vermiculite, perlite. Good quality growing media (soil less) characteristic are-

(i) High water holding capacity but also contains enough macrospores to allow excess water to drain away and prevent water logging.

(ii) Bulk density can also be used as a quick measure of how evenly growing media has been mixed, by comparing the weight of samples of equal volume from a batch of media. The bulk density of a wet growing media should be less than 1.0kg/l.

(iii) Good quality growing media total range between (50 to 70) % and it is composed of two parts: air and water. Both components are critical for good plant growth, but not enough of either can limit growth.

(iv) The stability of a planting substrate needs to be considered. It is undesirable to use a substrate that decomposes quickly, since this will result in a dramatic reduction in substrate porosity. The need for stable substrates is especially important for larger containers, which require more than a growing season for the plant to reach a marketable size.

(v) Cation exchange capacity (CEC) denote to the media's has capability to hold nutrients that contains a positive charge such as; calcium, magnesium, ammonium, potassium. As a result of the CEC, the media will have the ability to resist pH changes and nutrient levels. Even though it is one of the critical chemical properties of media, generally the grower does not intentionally manipulate or monitor the CEC. Since CEC of media varies depending on the components of the media, knowing the CEC will allow to develop fertility programs and to solve certain nutrient disorders. Compared to soil, greenhouse media content low amount CEC, therefore, nutrient add with water called fertigation.

(Vi) pH is the most important factor for soil or soil less growing media on pro tray nursery. Growing media pH is a measurement of the acidity or alkalinity in nature. Substrate pH is a critical issue because it plays a major role in determining the availability of many nutrients. If growing media show acid in nature so; calcium and magnesium, nitrate-nitrogen, phosphorus, boron, molybdenum are deficient but other side aluminum and manganese are abundant, sometimes at levels toxic to some plants. Phosphorus, iron, copper, zinc, and boron are frequently deficient in very alkaline substrate. Most greenhouse crops grow best in a slightly acid pH range of 6.2 to 6.8 in soil-based substrate and 5.4 to 6.6 in soilless substrate.

(vii) Growing media commonly formerly through organic materials, such as saw dust, coir, compost, bark, and peat moss. The growing media is best indicator that N_2 level higher or lower. When C:N ratio higher so, plant cant uptake N_2 from growing media. If the amount of carbon exceeds the amount of nitrogen from the organic materials, microorganisms use the nitrogen intended for the plant in the container.

Type of growing medium:-

Commonly two types of growing media are found such as; Soil and soilless growing media. Soil is the primary growing medium for growing plants. Commonly soil made from sand, silt, clay, loamy particle and mixed with organic matter. It is very cheapest and easily available loamy and porous soil, rich in organic matter with neutral pH (near about 7) is good for the growth of plants. Soil is mixed with sand and farmyard manure (2:1) for better water-holding capacity, aeration and nutrient supply to the plants.

Problem of growing medium as a soil:-

(i) In this medium are very difficult to control of nutritional status, pH status, and water holding capacity to the seedling for long period

(ii) If seedling growing under this medium so, more chance attack soil porn micro-organism

(iii) Some type of soil are saline, alkaline or less drainage so, this type of soil create more problems in soil aeration, porosity, nutrient uptake, etc., which in turn affect the crop productivity.

Soil less growing medium:-

Now a day's farmers face different types of problem through soil for seedling production; behind this reason soilless growing medium has vast scope for quality seedling production. Soilless growing medium basically used with portray nursery. Soil less growing medium are various types such as;-

(A) Cocopeat- Cocopeat develop from husk of coconut and tree of coconut tree, also known as *'Kalpvriksha,'* in Hindu mythology because all part of it is useful (Mary Henrietta, 2022). The Cocopeat, has different qualities. The primary grades which have low EC level, less moisture, and little fibre cater to export markets. Good quality Cocopeat should have low EC, less fiber content, pH range (5.5 to 6.5) which is suitable for root zone, good expansion ratio (upwards of 1:15). Domingues Salvador and Minami (2001) reported that the effects on plant growth and flower quality of different substrates (coconut fiber and perlite) used as growing media in lisianthus (*Eustoma grandiflorum*

(*Lisianthus russellianus*)) cut flower cultivation. Coconut fiber showed better effect on plant growth and flower quality than perlite medium.

(B) **Vermiculite-** It is an aluminum-iron-magnesium silicate. It is a mica-like mineral which expands to open-flake structures on heating at high temperatures. Vermiculite is available in various grades and particle sizes and can have a bearing on the choice, depending upon the size of nursery pots. The finer grades are used for small pots and nursery trays, while large or coarse grades may be used in large containers. Vermiculite has a range of pore spaces, which can retain considerable amount of moisture on wetting. It also contains important minerals, especially calcium and magnesium besides having a near neutral pH. Vermiculite is a critical desirable component of soilless root substrates because of its high nutrient and water retention and good aeration capacity while bearing a low bulk density.

(C) Rock wool:- It is made from spinning molten basaltic rock into fine fibres, which are form of cubes, blocks, growing slabs and granular products. Rock wool and other stone or mineral wools highly used in vegetable crops and flower crops originate from rock, they are considered by many to be a natural product. It is ground to produce a fine powdered or granular form. This powdered form used in the media provides good aeration and water-holding capacity. It is slightly alkaline in nature and naturally it cannot hold plant nutrient so, other growing media like sphagnum moss or artificially nutrient provided for better growth of seedling.

(D) Perlite:- Perlite is a silicous mineral of volcanic origin. It is white, sterile propagating medium used by growers to keep soil loose, allowing air and water to reach roots. It is suitable for seeds germination, for potting plants, to root cuttings, to hold cut flower and to help establish new lawns. in colour . Lightness and uniformity make perlite very useful for increasing aeration and drainage. Perlite is very dusty when dry and has a tendency to float to the top of a container during irrigation. It has also been shown that perlite contains potentially toxic levels of fluorine. Costs are moderate in the growing media but it the growing media has scientifically viable.

(E) Peat like moss:- It is develop from de-compost of sea plant but poorly drainage condition. Now a days it use widely in Horticulture sector but major dis-advantage of this growing media has highly sensitive of micro-organism so, before used sterilization is essential for healthy seedling production. It has four category such as;

(i) Reed and Sedge: - This peat commonly derived from the moderately decomposed remains of rushes, coarse grasses, sedges, reeds and similar plants. It has various colur some being dark brown and others being brown to red in color The reed and sedge has a finer texture, higher bulk density, pore space are lower so, lower air-filled poor space than sphagnum peat. A typical reed-sedge peat will have a total pore space of approximately 80%, and air-filled pore space of 10% to

14%, a water-holding capacity of 65% to 67% and a bulk density of 0.14 to 0.16 g•cm^{-3} and pH rang are (5-5.5).

(ii) Peat humus:- The colour of peat humus are dark brown to black in color and is the most highly decomposed of all of the major types of peat. It is usually derived from hypnum or reed-sedge peat. It is decomposed to such a degree that the original plant remains are indistinguishable. Whereas sphagnum, hypnum and reed-sedge peat are usually greater than 90% organic matter, peat humus may contain significant amounts of mineral soil. The pH may range from 5.0 to 7.5 and it may have a moderate to high electrical conductivity and may contain moderate to high levels of nitrogen

(iii) Sphagnum moss: – It is the dehydrated remains of acid-bog plants from the genus Sphagnum (https://aggie-horticulture.tamu.edu/ornamental/greenhouse-management/growing-media). It is very light in weight and has the ability to absorb 10 to 20 times its weight in water. This is attributed to the large groups of water holding cells, characteristic of the genus. Sphagnum moss contains specific fungistatic substances which accounts for its ability to inhibit damping-off of seedlings. Sphagnum moss is perhaps the most desirable form of organic matter for the preparation of growing media. Drainage and aeration are improved in heavier soils while moisture and nutrient retention are increased in lighter soils. Germany, Canada and Ireland are the principle regions of Sphagnum moss production.

(iv) Hypnaceous moss: – this type of peat consists of the partially decomposed remains of hyprum, polytrichum and other mosses of the Hypanaceae family. Although it decomposes more rapidly than some other peat types, it is suitable for media use. Many of the peat deposits in the Northern United States are Hypnaceous

(F) Sand:- It is the primary component of soil. The range of soil particle size from (0.05 mm–2.0 mm) in diameter. It improves aeration and drainage and requires minimum cost incurrence. Sterilized is require before using this growing media because, it has greater chance for disease & pest attack. It can prove to be a good medium for both potting and propagation media.

(G) Rice Husk:- Rice husk is the byproduct rice milling industry. It is extremely light in weight and is very effective for better drainage and aeration.

(H) Saw dust:- Several species of plant parts use for saw dust and it also use for as a type of growing media. Different saw dusts, such as walnut and non-composted redwood, are known to have direct phytotoxic effects which are harmful to seedling. However, the C:N of sawdust is such that it is not readily decomposed. The seedling growth also hampered when high amount

cellulose and lignin content along with insufficient N content. If artificially application N so, check the problem.

(I) Barks:- Bark also primarily a bi-product of the pulp, paper and plywood industries. Suitable particle size is obtained by hammer milling and screening. In this product are very cheap and easily to available. It has good potential power for proper aeration and better water holding capacity; if mixed with one-fourth part of peat moss. Bark particles of less than 3/8 inch (9.5 mm) in size are used as growing media in general. Bark has low nutrients and very low pH (3.5–6.5) when used unprocessed. For recover the pH of the bark medium so, lime may be added to increase of level pH 6 above.

Composition of growing media:- According to the types of plant species; specific types growing media require. Some time single type growing media require but some case combined type growing media require for better seed germination because Plant support, aeration, nutrient, moisture retention and better water holding capacity. The ideal composition of soilless composition includes composite mixture of coco peat, vermiculite and perlite in 3:1:1 ratio. In case of seedling nursery, coco peat alone may be used as a growing media after treating it with calcium nitrate (50 g/kg) to reduce the electrical conductivity and pH of the media. If timber is available in abundance, use of bark as a growing medium is economical. Plant growing media like sand is the most suitable for cutting of ornamental plants because; it has good aeration capacity, pH rang also moderate and EC rang also perfect. Some information of growing media describe below-

Raw Materials	**Total Porosity**	**Water Holding Capacity**	**Air Capacity**	**pH**	**CEC (me/cc)**
Peat	90-95	75-80	10-20	3.0-5.0	7.0-14.0
Bark 75	75-80	58	20-25	4.0-6.5	10-12
Bark 75	90-94	82-83	9-12	6.5-7.5	6.1
Bark 75	68	36-40	28-32	7-7.5	0.16
Bark 75	78-80	70-72	6-10	5-7.5	1.9-2.7

Table No-1 Properties of the five major growing media components

Attribute	**Propagation Mix**	**Peat-Lite Growing on Mix**	**Bark-Based Growing on Mix**
Particle Size	Fine	Medium to Coarse	Medium to Coarse
Air Space	Low to Moderate	Moderate to High	Moderate to High
Water Holding	High	Moderate	Moderate to Low
Longevity	Short	Short to Medium	Short to long
Nutrient Needs	Low	Moderate	Moderate to High

Table No-2 Desired properties of mixes for various uses in greenhouse production

Growing media	Substitute media	Concerns	Result
Peanut Hulls	Substitute for saw dust and bark	Customer fear related to peanut allergies	The composting process removes the possibility of allergic reactions.
Rice Hulls	Substitute for perlite or illite	Rodents are very sensitive to rice hulls and rice hull mixes	In large quantities, they can provide some silicon for plants
Vermicompost	Other growing media little mix with vermicompost	None	Very good result when added at 10 to 15% of other growing media
Wood Chips/Wood Dust	Substitute for perlite or vermiculite or bark	Nitrogen reduce	More of a regional component
Pumice	Substitute for perlite	None	Common in the west
Yard Waste Compost	Small percentage addition to mix	Source of waste may sometimes have undesirable contaminants	Can increase nutrient and water holding in a mix and need to make sure there are no herbicide contaminants

Table No-3 Uses of the regional growing media components

Sterilization on growing media (Soil): - Sterilization is the most important technique for purification of soil or other growing media. According to this process soil born disease, pest, microbes and other weed seed are fully destroyed. Different types method can be apply for sterilization on soil or other growing media such as; Solar sterilization, Steam sterilization, Formaline sterilization, Fungicide treatment, Soil fumigation.

Advantage of growing media (soil) sterilization:-

(i) Sterilization provides quick relief for the soil from substances and organisms that are harmful to the plants

(ii) It strongly destroyed unwanted weeds and later to a significant increase in crop yield

(iii) Soil sterilization helps to revitalize the soil with the activation of chemical-biological reactions

Dis-advantage of growing media (soil) sterilization:-

(i) Proper knowable person require for application on this process

(ii) Carefully handling because of flammability is toxicity and create health problem

(iii) Solar sterilization requires more time and depends upon nature.

(iv) Chemical and Heating process is costly

(v) Decreased effectiveness when improperly processed

(vi) Many beneficial microbes killed when application on soil sterilization

(1) <u>Soil sterilization through solar</u>:- In this process fully controlled by sun and it is the ultimate source of heat. Killed soil born micro-organism through application of solar heat method. This method very cheap and all over the year; except rainy season. Application on solar sterilization process describe below-

- Open the soil through cultivator during summer month before preparation of nursery beds.
- Cover it woth clear polythene sheet for one month.
- Seal the sides of the polythene sheet airtight with mud.
- This process leads to increase soil temperature during the hottest part of the day.
- This is one of the most effective and eco-friendly methods for the management of disease causing soil pathogens, elimination of weeds, toxic metabolites, insect-pests etc.
- It won't kill the beneficial soil microbes.
- This method is effective for the control of dominant soil pathogens like Fusarium sp., Meloidogyne sp., Pseudomonas sp., Verticillium dahliae, Pythium sp., and Phytophthora sp., which are responsible for many diseases in tomato (Olson, J. 2021).
- Soil sterilization also increases the vigour of seedlings and yield increase

Advantage of solar sterilization:-

- Solar energy absolutely free

- It is an eco-friendly method of soil treatment
- No technical person require for application this method

Dis-advantage of solar sterilization:-

- This method strongly depend upon nature so, less effective during rainy and winter season

(2) <u>Steam sterilization</u>:- Steam sterilization is the another technique for treatment of soil by using steam. It is an artificial method of soil treatment. Application on steam sterilization technique which describe below-

- We need commercial boiler to generate the steam under pressure
- Lay out perforated pipes underground in the nursery at a depth of 20-25 cm
- Pass steam through these pipes continuously for 4-8 h unless the soil temperature reaches 80℃
- Retain this temperature for at least 30 minutes by covering the soil with polythene sheet to destroy the disease causing pathogens
- Soil temperature should never go beyond 90℃
- This process is very effective for controlling soil borne diseases, insect-pests and weed-seeds
- We can also use this method for the sterilization of potting medium
- This method is very useful to get healthy seedlings

Advantage of steam sterilization:-

- This is highly effective
- It is an organic and eco-friendly method of soil treatment

Dis-advantage:-

- This method are highly costly and require electricity for application this method

(3) <u>Formaline sterilization</u>:- It is also chemical process for soil sterilization and commonly formaline are colour less in nature. Formalin form of water with formaldehyde, used chiefly as a

preservative for biological specimens. Application on formalin solution technique which describe below-

- Pulverize the soil by repeated ploughing, and drench it with 1% formalin solution up to depth of 15 cm or more.

- Roof the nursery beds with thick polythene sheet for 5-10 days.
- Seal the sides of the polythene sheet airtight with mud.
- Hence, formalin fumes will enter the soil and kill all disease causing soil pathogens and insect-pests.
- Remove the polythene sheet after a week.
- Open the soil and leave it for few days until the formalin smell completely disappears

(4) **Soil fumigation:-** Soil fumigation is a very common cultural practices and also soil sterilization method. Soil fumigation mean mixing pesticide or fungicide with soil so, later gas form and killed different types pest, bacteria, fungi, nematode, white ant and weeds (Metych, 2016). This process basically used in high value crops field. Major four chemical use commercially use for soil fumigation purpose such as; Methyl bromide, Chloropicrin, Vapam, Methyl iodide. Application on soil fumigation technique which describe below-

- Methyl bromide and methyl iodide are the most common and very effective fumigants.
- Little amount of these chemical is enough to destroyed soil borne pathogens.
- After application of these chemicals, cover the soil with thick polythene sheet for a period of 10-14 days.
- This treatment is very effective for protected or open field condition.
- Chloropicrin is a wide-spectrum fumigant that controls soil-borne insects, fungi, and bacteria and nematode. Chloropicrin is often formulated with methyl bromide, iodomethane, DMDS, and 1,3-D. It may be formulated as the sole active ingredient (Goldammer, 2019)

(4) Gamma radiation:- It is other type of common soil sterilization technique. Gamma irradiation at 10 kGy is powerful enough to eliminate actinomycetes, fungi (Manamara *et, al.*, 2003) and invertebrates in most soils, and most soil bacteria can be eliminated by 20 kGy. Certain contaminants — namely radio-resistant bacteria — require y-irradiation at 70 kGy.

Boiling water:- The boiling water method is a simple cheapest technique for sterilizing planting media. First, fill a heat-resistant container with the planting media and pour boiling water over it until it's covered. Then, cover the container and let it cool before using. While this method is effective and easy, it may not be suitable for large quantities of planting media and in this process not completely all types microbs.

Microwave:- Microwave is the scientific method for growing media sterilization. To use this method, fill a microwave-safe container with the planting media and need for heating 5-10 minutes. Proper carefully handle after sterilization because container are very hot.

Conclusion:- Agriculture is the backbone of Indian economic and it has huge potential power to increase self employment of rural peoples. Now a day's increase population year after year and simultaneously reduction Agriculture land. Later portion of Agriculture land includes soils with high salt content, sodic or polluted content, poor soil structure and less soil fertility is the major problem behind this region soilless growing is the another option to produced quality seedling. Soilless growing media basically use high value crops like flowers and vegetable. Before using growing media should be sterilization because; killed the soil borne microbes and destroyed other weed seeds. Seedling rising on portray nursery with protected or green house condition that result plants are vigor in nature and healthy planting materials produce that result; less amount planting materials require per unit area. Generally farmer's field application solar sterilization or chemical sterilization on soil but chemical sterilization method is more harmful for soil health and beneficial microbes. Mostly use soil less media for cut flowers, vegetable crops and some spice crops.

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