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Strategies for Weed-Free Tapioca: Boosting Yield and Efficiency

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Tapioca (Cassava) is a tropical root crop, grown as deprivation reserve and against the devastating migratory locust in Africa. All parts of the tapioca plant, including the roots and tubers, are used as food for humans and animals, as well as a raw material for industrial products based on starch. In the meantime, starch is used to make adhesives for cosmetics, sizing in textiles, laundry, and paper production. It is considered as a king of "tropical tuber crops". A root crop, tapioca is also referred to as manioc in French-speaking nations and cassava in others. Its origins are in South America, specifically in Brazil, Peru, Mexico, Guatemala and Honduras. For three to seven thousand years, it was grown in these nations before spreading to other regions of the world. In 17th century Portuguese landed in Malabar region, now the part is Kerala state and they acquainted with "Maravalli kizhangu" (Tamil) into India. The top developing nations in the globe are Nigeria, Ghana, Brazil, Thailand, Indonesia, and India. Approximately 93% of the country's acreage and 98% of its production is cultivated in the southern peninsula of India, specifically in the states of Kerala, Tamil Nadu, and Andhra Pradesh. India has 207.59 hectares of tapioca land, with 4372 MT produced. Rainfed cassava is mostly grown in Kerala, which makes up approximately 50% of the entire area under cassava in India. Tapioca is rich in carbohydrate and third-largest source of food in tropics after rice and maize. The world's greatest producer of tapioca is Nigeria while Thailand is the leading exporter of tapioca starch. Tapioca is a substantial, stable food that can be grown on marginal soil; most drought-tolerant crops have the capacity to thrive on this soil type. Cassava is essential for providing food security and generating money for resource-poor farmers due to its ability to thrive in marginal environmental circumstances. The crop is less vulnerable to pests and illnesses, but in the first three to four months after planting, it becomes more vulnerable to weed interference due to its sluggish early development and insufficient canopy cover. According to IITA (1990), tuber yield reduction ranges from 40% in early branching cultivars to about 70% in late and non-branching cultivars. This suggests that in order to get higher yields, efficient weed management techniques are needed throughout the early growth periods of cassava.

Tapioca crop

Tapioca (Cassava) belongs to family Euphorbiaceae. It is a perennial shrub that yields five to ten cylindrical tubers on each plant. The stem has multiple branches and is made of wood. There are two different kinds: the one with spreading nature and the one without top branching. The leaves have five to nine lobes that are lobed palmately. Cassava is natural, cross-pollinated and monoecious. Male flowers are borne above and female flowers are scarce in number and borne toward the base of the inflorescence.

Tapioca is a shrub that grows perennially; it has latex throughout its entire body; its roots are enlarged tubers; its height ranges from 1 to 3 meters or more; it has two distinct plant types: the erect type, which is tall and the spreading type, which is very low branching

(even reaching 20 cm), angle is much wider and the stem is usually slender and glabrous. Tapioca roots are intense in the top 30 cm, even though the source root sinks to a depth of 140 cm; each plant typically has 5 to 10 tubers, which are tapering and measure between 15 and 100 cm in length and 4 to 16 cm in diameter.

A typical tap root system is produced by plants that are grown from seeds. A lot of adventitious roots form because the crop is mostly grown vegetatively by stem cuttings; some of these roots eventually become tubers. Few peridiums develop into tubers, which are made up of a thin layer of tissue. A thin peridium, a huge center meat that is rich in starch (25 to 40%), and a white or purple cortex known as the rind make up tubers. A bitter component called cyanogenic glucoside (HCN) is responsible for the bitterness that is frequently found in some types and at particular stages.

Tapioca is classified into two type are Sweet and Bitter type, *Manihot esculenta crantz* is known as sweet type it's consists of low Hydrocyanic acid (HCN) < 100 mg to about 20 mg kg^{-1}cyanogenic glucoside content. The sweet type Tapioca plant is short duration crop growing season tuber root are mature in 6-9 months and bitter type tubers are mature 12 to18 months ideal annual rainfall is 1000 to 1500 mm, but crop grown successful in range 500 to 2500 mm. It can withstand for prolonged period of droughts.

Influence of weeds on Tapioca

Weed are unpleasant to the plant, may grow to hinder with the incident of the primary plants. Farmers often wait until two months after planting to do their first weeding. The production of tubers may be reduced by 20–50% as a result of weed competition. Higher labor costs for manual weeding result in higher production costs. The best way to manage weeds in cassava to increase tuber productivity is by chemical weed control. Herbicide use is less expensive than four times as much hand weeding. Farmers who shifted from hand weeding to chemical control used 54% to 96% less labor for weed control. About 150–200 man days per year and 30% of the labor input are spent on weeding. Surveys conducted by farmers have revealed that, aside from a lack of technical proficiency in using herbicides, the biggest barrier to the non-adoption of herbicide use in cassava is ignorance.

The initial weeding of the tapioca plant should be done twenty days after planting, and depending on the conditions of the field, there should be three further weeding done after 40, 60, 90 and 120 days. Critical stage of the crop is 60 to 90 days after planting planting and yield should be loss up to approximate 55 to 75 % in tubers.

Major weed species in Tapioca

Weeds are mostly affecting in first three month vulnerable damage to the crop. *Cyperus rotundus, Cynodon dactylon, Trianthema portulacastrum, Euphorbia hirta, Megathyrsus maximus, Cyperus difformis , Imperata cylindrical, Eleusina indica etc.*

Cynodon dactylon: The leaf blades of the *Cynodon dactylon* are small, linear, and often blue-green in color. They measure approximately 8 cm in length and 3 mm in width, tapering from base to tip. It has four to five thin, purplish spikes that can reach a length of 10 cm or 60 cm, arranged in a star-like pattern from the stem's end, together with three to six racemes.

Management: Digging up to 20 cm depth + post emergence spraying of glyphosate @ 2.76 kg/0.1ha at active growth stage + 2nd spraying 20 days thereafter.

Cyperus rotundus*: Cyperus rotundus* is a perennial, glossy- green weed with an erect triangular stem branching into three stems of purple, antenna like seedpods. Plant die back to ground fall, with new shoots emerging in spring from underground tubers.

Management: When the tapioca is two months old at the age of three months we should spray with 48% glyphosate at the rate of 70 to 80 CC per bucket of water. It will die slowly within months.

Trianthema portulacastrum: It is annual weed grow up to meter long. Green to red colour, hairless except for small lines of hairs near the leaves and fleshy. Leaves are small round or oval blade up to 4 centimetres long borne on short petioles.

Management: Use various pre and post emergence herbicides like oxyfluorfen, isoproturon, oxadiazon, pendimethalin and fluchloralin followed by hand weeding and earthing up to control effectively.

Conclusion

Weed management strategies in tapioca should be focused on ecological zones. Weed present in cassava field reduces yield upto 65 to75% .Weeds are mostly predominant in first three months upto harvest usually broadleaf and grass leaf are present dominant in field. It was better to practice application of pre-emergent herbicides like pendimethalin along with hoeing and earthing up at 60 DAP for effective weed control and reduction in cost of cultivation. Weed control by hoe weeding and earthing up alone may increase the cost of production because of higher labor requirements.

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