

## Pineapple as an Intercrop in Mango Orchard: A Step towards Doubling Farmer's Income

Abhilash Padhan<sup>1\*</sup>

<sup>1</sup>Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh

ARTICLE ID: 60



### Introduction:

Pineapple (*Ananas comosus*) is a perennial fruit crop grown in the tropical and subtropical areas of the world which belongs to the family *Bromeliaceae*. It is originated in the Parana-Paraguay basin according to Collins (1960). The pineapple was domesticated by the Tupi-Guarani Indians. In the Gurani language, “a” means fruit & “nana” means “excelling”. The generic name *Ananas* stands for the excellent edible quality of this fruit. It is an excellent source of Vitamin C and is a good source of Vitamin A and B. It seems to have reached India by 1558 (Hayes, 1957). The most important producers of Pineapple in recent years have been in Thailand, Philippines, Hawaii, Brazil, Indonesia, Mexico, Taiwan, South Africa, Australia, China, Nigeria, Columbia & India. The major producers of Pineapple in India are Assam, West Bengal, Tripura, Kerala, Goa, Orissa, Bihar, Manipur, Karnataka, and Meghalaya.

### Plant characteristics:

It is an herbaceous perennial plant. The mature plant is 1.0 mtr to 1.2mtr in height and 1.3mtr to 1.5mtr in diameter. Like banana, it is monocarp (each stem flowers only once & dies after fruiting). Once the plantation is done it will live up to 50 years. The plant appears to suit for Xerophytic conditions. The lower epidermis of the leaf bears trichomes which absorbs water from the atmosphere & reduce transpiration, while the leaf itself contains a specialized water storage tissue. The stem is 20-30 cm long, narrow at the base & wider on the top. The meristem produces 70-80 leaves unless it is prematurely induced to bloom. The time between planting & formation of inflorescence varies between 6 to 16 months depending upon the size of the propagule, date of planting, climate, and soil(Samson,1986). The fruit is formed by an extensive thickening of the axis of the inflorescence and by the fusion of small, berry-like fruits produced by each flower. There are 100-200 individual fruits arranged spirally around the thick axis & the whole forms a broad almost cylindrical multiple fruit. The average fruit size is 20 cm long and 14 cm broad. The fruit tapers towards the top where it is mounted by a rosette of short, stiff, spirally arranged leaves called the crown.

### Cultivars:

According to Knight (1980), all cultivated Pineapples may be placed according to their characteristics in 5 major groups. The name of different groups and the cultivar's name are mentioned below here. These includes:

Group Name	Popular Cultivars
Spanish Group	Red Spanish, Singapore Spanish, Green Selangor, Castilla, Cabezona, P.R.1-67
Queen Group	Queen, MacGregor, Z Queen, Natal, Ripley, Alexandria
Abacaxi Group	Perola, Abakka, Sugar Loaf, Papelon, Amarella, Venezolana, Ananas Vermelho
Cayenne Group	Smooth Cayenne, Cayenne Lisse, Boron Rothschild, Smooth Guatemalan, Typhone, St. Michael, Esmeralda
Manipure Group	Manipure, Bumanguesa, Piamba de marquita, Randon,

	Perbola:Legrija and Monte Liro
--	--------------------------------

Some of the most popular varieties like Giant Kew, Kew, Mauritius, Jhaldjup and Bakhat grown in India do not find mentioned in the above group list.

**Climatic Requirement:**

Pineapple is a crop of the tropical climate but it thrives well in the subtropical situations. It is susceptible to frost so its cultivation is limited to latitude between 25<sup>0</sup> N & S with a few exceptions like Assam (30<sup>0</sup> N) & Port Elizabeth (33<sup>0</sup>S) in South Africa (Samson,1986). The optimum day & night temperature for pineapple were reported to be about 30<sup>0</sup>C & 20<sup>0</sup>C respectively (Neild & Boshell, 1976). Bartholomew & Kadzim in (1977) have reported that leaves & roots grow best at 32<sup>0</sup>C & 29<sup>0</sup>C. However, growth ceases below 20<sup>0</sup>C and above 36<sup>0</sup>C. In general, pineapple needs a sunny climate through there are no exact figures on hours of solar radiation required. In India, Pineapple is grown commercially in Assam, West Bengal, Bihar, Coastal Andra Pradesh, Kerala, Karnataka, Odisha, Goa, Tripura, Meghalaya and Tamil Nadu. The average annual requirement of rainfall ranges from 1000 mm to 1500 mm. Successful production in low rainfall areas requires good annual distribution of rainfall & water conservation management practices. In high rainfall areas, good drainage is most important as the pineapple root system is very sensitive to waterlogging.

**Plant propagation method:**

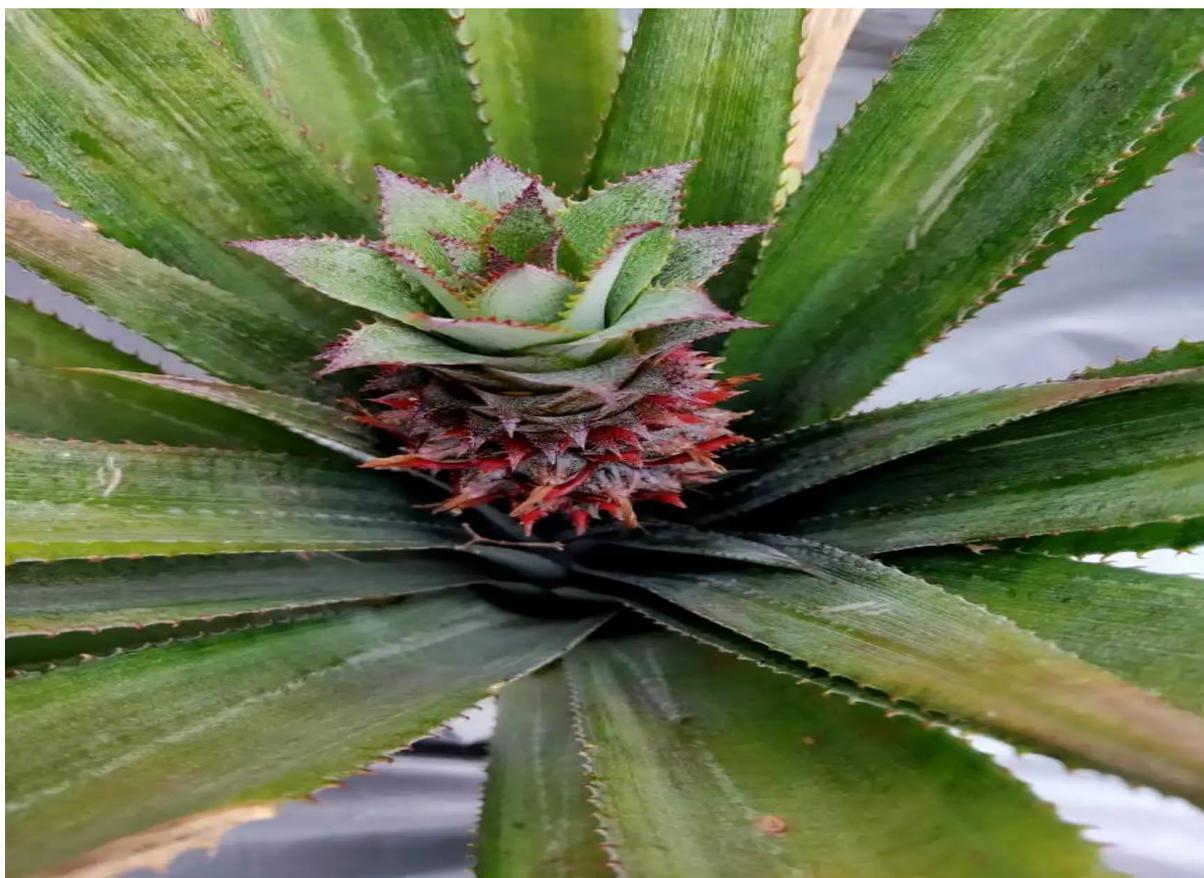
It's commonly propagated by different asexual means such as suckers, slips, and crowns. The axillary shoots originating from the base of the plant are called as suckers. Side shoots of the suckers or those originating from just below the fruit are known as "Slips" & the leaf rosette on the top of the fruit is the "Crown". The different time period of production of fruits is 18 to 20 months using Slips, 15 to 18 months using Suckers and 22 to 24 months using Crowns.

**Precautionary step:**

Before planting all the planting materials must be cured or dried for one to several weeks after separated from the mother plant. This allows the formation of a callus layer on the cut surface which reduces losses from decaying organisms.

**Cultural practice:**

It is raised in a double-row system. Traditionally Pineapple was raised with a recommended spacing of (100\*60\*30)cm with a plant population of 39,000P/ha for market production whereas with a spacing of(100\*45\*30)cm with 43,500P/ha can be applied for canning purpose. Chadda *et al.*(1974) recorded the best results using 63,758 plants/ha while Mustafa(1988) obtained the highest yield with 59,829 plants/ha.

**Flower induction:**

Inflorescence development is initiated naturally by shortened day length & cool night temperature. Usually flower initiation begins in November & continues throughout the winter till February. Under natural conditions flowering is highly irregular & some plants may fail to produce fruit. Thus, in commercial practice, growth regulators such as ethylene & NAA are used to force plants to flower. Flower initiation in pineapple is promoted and fruiting becomes more even when pineapple is treated with ethylene. Water deficit or drought like situation also induces early flower initiation in pineapple. Now a days synthetic plant hormones like NAA or ethylene are often used to induce flowering. In the past calcium carbide ( $\text{CaC}_2$ ) was employed for this purpose.

**Crop regulation:**

Use of different planting material allows manipulation of the crop growing period and particularly in selection of the time of harvest when climatic conditions are favorable for high quality fruits. As its growth cycle & flowering is not influenced by seasonal influence, it gives additional advantage for planning fruit production in advance to suit the market.

**Harvesting & Yield:**

The pineapple produces a composite or multiple fruit, made up of numerous individual fruit lets which are fused together to produce pineapple. The half yellow stage is regarded as ripe & at this stage brix & Titrable acidity has reached maximum. This stage is near the maximum in fruit weight Yield is 40-50 t/ha may be expected from a well-managed plantation. Under optimal conditions the yield goes up to 70t/ha or even more (Samson,1986).

**Pineapple as an intercrop:**

As it's a semi-shade loving crop intercropping Pineapple inside Mango orchard for commercial purposes between two rows of mango can be done using a double row system in flatbeds or using raised beds whereas it can be grown with or without the use of mulch.

## **Pineapple as an intercrop in Mango orchard: A success story of a progressive farmer from Boud district of Odisha.**



Sangram Pradhan (40) is a highly progressive farmer from Boud district of Odisha who has specialized in farming of Mango from the last 10 years. After completing his higher education in law he has working in an MNC in Mumbai. But his interest & passion for agriculture made him to come back to his native village Balanda of Purunakatak area of Boud district of Odisha. Along with his father Sri Prafulla Kumar Pradhan (62) he is involved in cultivation of mango using latest technology and using it in his 15 acres of mango orchard which was established by his father before 15 years back situated next to his house at his native village. At present, he maintains a diversity of 22 different cultivars of mango with more than 1600 plants in an area of 15 acres. The mango varieties he grows for commercial purposes include Baiganpalli, Mallika, Neelum, Kesari, Ratnagiri Alphonso, Arka Neelachal Kesari, Ratnagiri Hapus, Baramasi and recently introduced the Thai Mango varieties. Out of total 15 acres of the area, he grows Amrapali variety (a dwarfing variety suitable for high-density planting developed by the crossing of Dashehari and Neelum) in an area of 5 acres from last 12 years.

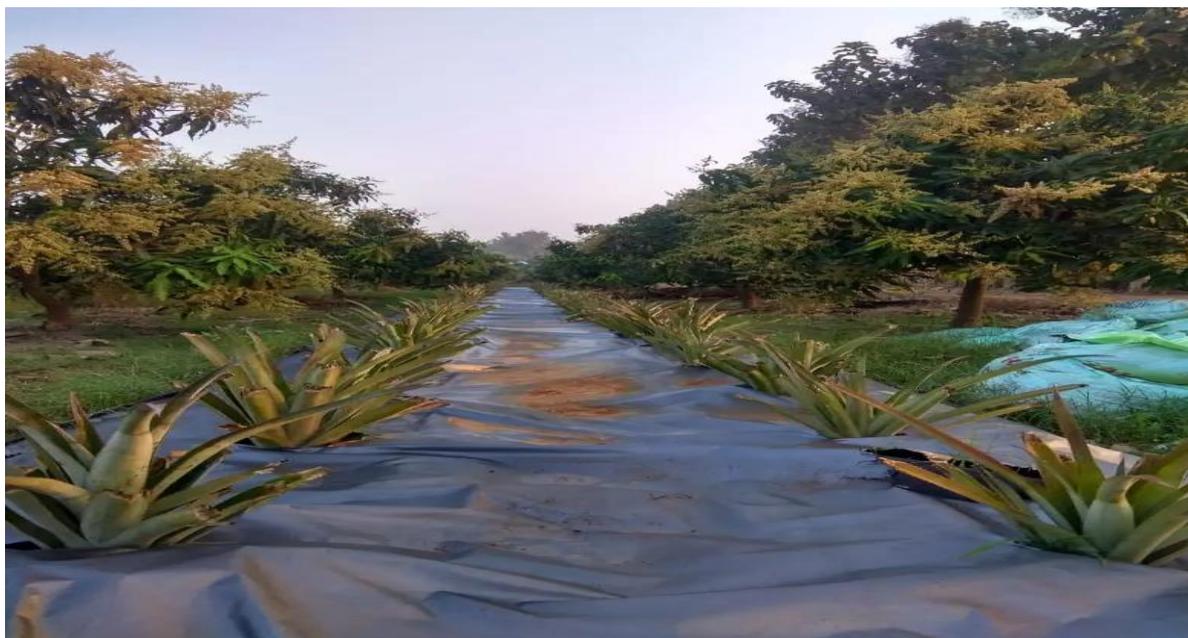
The spacing he has followed is  $5 \times 5$  mtrs. in Amrapali mango variety. By regular training and pruning operation in Amrapali the plant height is maintained up to 10 feet after harvesting each year. Although he was highly successful in mango cultivation utilizing the latest technologies, he was not getting more than an annual profit of 50,000 Indian rupees per acre from his Mango orchard. So he decided to go for an intercrop inside the Amrapali mango orchard where an interspace of  $25 \text{ m}^2$  ground area (Neglecting tree girth and spread



area) was available between two different rows of Mango Plantation. After attending several pieces of training and workshops on Pineapple cultivation as an Intercrop in Mango orchard at CHES (Central Horticultural Experiment Station), Bhubaneswar which is a sub research station of IIHR (Indian Institute of Horticultural Research), Bangalore, he finally decided to start pineapple cultivation as an intercrop utilizing the latest technologies and pop (Package of Practices) developed by CHES, Bhubaneswar. He started pineapple cultivation by purchasing 6000 numbers of suckers (as planting material) of Queen and Kew variety of Pineapple. He started the cultivation by preparing a raised bed inside the rows of Amrapali mango. The raised beds were prepared using compost and soil of height up to 7 inches and a breadth of 5 feet at the base to 4 feet at the top. The total length of one bed was extended up to 40 meters. The suckers were planted above the raised beds in two rows with a spacing of 2 ft. between the R-R and 2 ft. 2 in. between the P-P. A total of 110 numbers of suckers were planted in a single bed of 40 meters length between two rows of mango. The silver-coated black polythene of 200  $\mu$ m thickness was used as a mulching material whose life span is up to 3years.

#### **Benefits of raised bed & polythene mulching in Pineapple:**

In case of using polythene mulching, there is a complete protection from weed growth up to 3 years using this mulching. The suckers of pineapple were planted during October to November month of 2019. After 7-8 months it completed its vegetative stage and started the reproductive stage by the initiation of flowering. The fruit maturity and harvest begin in May & June months of the coming year when its flowering initiation occurs during November-December. From the previous experiments by CHES, Bhubaneswar he was acknowledged about the yield of the cultivars he has transplanted. He got an average yield of 1.0-1.5kg of fruit/plant/year in Queen Cultivar whereas, in Kew, he got an average yield of 1.5-2.0kg of fruit/plant/year. The raised bed helps proper root growth due to good aeration in soil & prevents the water stagnation & damage to the plant's roots from various fungal and bacterial diseases. Utilization of polythene mulching not only prevents competition with weeds growth but also helps the plants to complete its vegetative growth within short spans and initiate flowering. Using mulching practice not only minimizes water loss & but also maintains optimum soil moisture & temperature and provides a suitable environment for soil microbial population which are beneficial for the plant root.

**Farmer's initiative:**

In natural condition, pineapple starts flowering during the month of November and the fruits are harvested after 4-5 months during May-June. During this time period due to large scale production in south Indian states, it fetches a maximum market price of 25-30 rupees per fruit in Odisha. But during the off-season in the months of November and December, it fetches up to 50-60 rupees per fruit in the market due to high demand in Marriage functions as dessert purposes. Mr. Sangram applied Planofix (NAA) with Ethereal (Ethephon) to induce flower initiation in pineapple during the month of August by utilizing synthetic flower initiating hormone and he was able to harvest the mature fruit during off season (November-December) and received a higher return.

**Profit Analysis:**

The total number of Pineapple suckers which can be planted in one acre as an intercrop in Mango is around 2000. The cost of suckers is 5-6 rupees each and once purchased it can be used for life long, so here we are neglecting the initial cost of purchasing the suckers as planting material of Pineapple. If a grower will get an average yield of 1 kg fruit/plant/year, then total yield will be around 2 tons of fruit/acre/ year. By taking average market selling price of each fruit 25 rupees during the on-season then the grower will get up to 50,000 rupees per acre. Whereas by artificial induction of flowering in pineapple during the month of July-August he will be able to harvest the fruit during the off-season

(November-December) and will get a double price (50-60 rupees) per fruit. In that case, the grower will earn up to 1 lakh rupees per year. The maximum cost of cultivation from the second year onwards will be lesser which will be around 10,000 rupees per acre including all costs. The grower will be able to generate additional profit of 40,000 to 90,000 rupees per year by taking Pineapple as an intercrop in Mango orchard.

**Conclusion:**

Taking pineapple as an intercrop will not only double the profit of the farmer within a year of time span but also will provide an assurance of benefit from intercrop when the main crop (Mango) production falls due to irregular bearing or other environmental factors. This is an innovative step towards doubling the farmer's income in the tropical and subtropical areas of India.

**References:**

- Bartholomew/ D. P., and S .B. Kadzimin. 1977. Pineapple pp. 113- 156. In: Alvim/ P. T./ and T. T. Kozlowski (eds.). Ecophysiology of Tropical Crops. Academic Press/ San Francisco. 502 p.
- Chadha, K.L., Melanta, K.R. and Shikhamany, S.D. 1974. Effect of the Type and Size of Planting Material on the Vigour of the Subsequent Plants, Yield and Quality in Kew Pineapple [*Ananas Comosus* (L.) Merr.]. *Indian Journal of Horticulture* 31(1): 9-15.
- Collins, J.L. 1960. The pineapple: botany, cultivation and utilization. Collins, J. L (eds.) Leonard Hill, New York. pp 294p.



- HAYES, W.B.1957. The pineapple. In: FRUITS growing in India. 3<sup>rd</sup> ed. Kitabistan, Allahabad: [s.n.]. p. 365-381
- Neild, R. E. and Boshell, F. 1976. An agroclimatic procedure and survey of the pineapple production potential of Colombia. Agril. Meteorol., 17 (2): 81-92.
- Samson, J.A., 1986. Pineapple. In: Tropical Fruits, Samson, J.A. (ed.). 2nd Edn. Longman Scientific and Technical, England, ISBN: 9780582404090, pp: 190-216

