

Feasibility of Intercropping in Oilseed Crops

¹K. N. Patel, ²K. M. Patel and ³S. D. Vahora

^{1&3}M.Sc Student, C.P.College of Agriculture, Sardarkrushinagar Dantiwada Agriculture University, Sardarkrushinagar, Gujarat

²Assistant Research Scientist (Agronomy), Department of Seed Technology, Sardarkrushinagar Dantiwada Agriculture University, Sardar krushinagar, Gujarat

ARTICLE ID: 20

Oilseed crops are one of the most important cash crops grown in India. Oilseed crops are grown primarily for the oil contained in the seed. In India, oilseeds are cultivated over an area of 28.83 million hectares with a production of 35.94million tonnes and in Gujarat, oilseeds are cultivated over an area of 3.35 million hectares with a production of 6.18 million tonnes (Anonymous, 2021).India is one of the major oilseed grower and importer of edible oils which is about 13.1 million tonnes of oil annually during 2020-21.India's vegetable oil economy is world's fourth largest economy after USA, China and Brazil. Oilseeds are mainly used for extraction of edible oils and it is the chief source of fats and proteins.

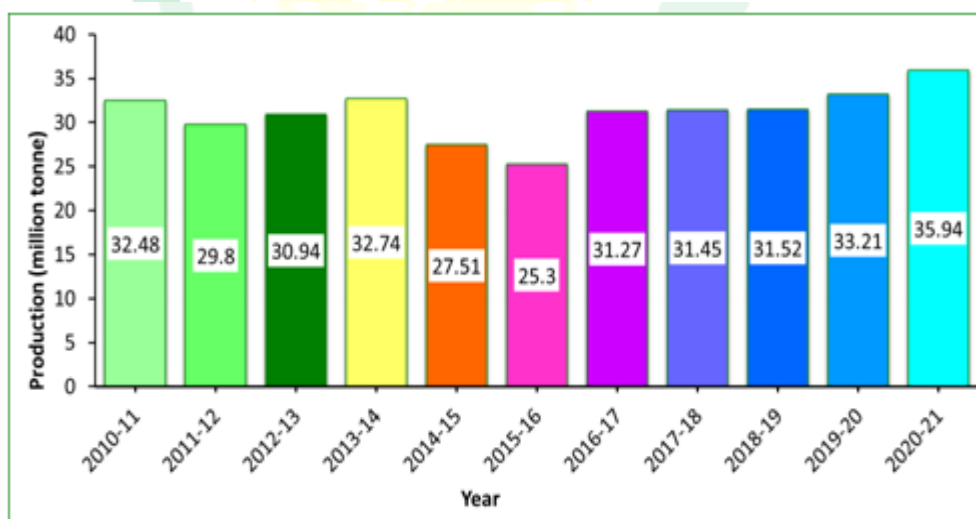


Fig. 1: India's oilseeds production from 2010-11 to 2020-21.

Intercropping is recommended to be used in many parts of the world for food or fibres productions, because of its overall high productivity, effective control of pests and diseases, good ecological services and economic profitability. In an intercropping system, there are often two or more crop species grown in the same field for a certain period of time, even though the crops are not necessarily sown or harvested simultaneously.

In diverse agro-climatic condition of India total 9 oilseed crops – soybean, groundnut, castor, sesamum, mustard, linseed, sunflower, safflower and niger are grown out of which castor and linseed are non-edible oils.

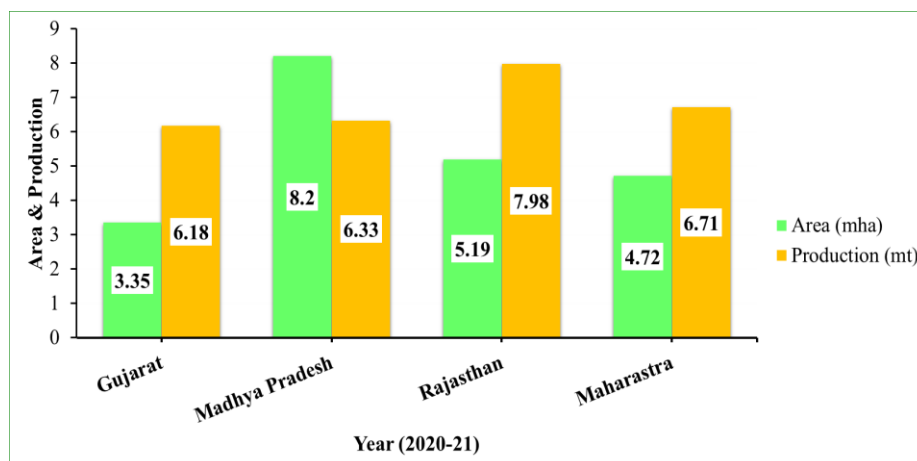


Fig. 2: Leading states of oilseeds producers in India during

Madhya Pradesh stands first for the area under cultivation of oilseed crops. Total soybean cultivated area in India is about 12.98 million hectares out of which 79% area comes under Madhya Pradesh. Rajasthan ranks first in oilseeds production as it is largest producer of rapeseed-mustard and second largest producer of soybean in India. While, Gujarat secure fourth position for area under cultivation and third position for production of oilseed crops in year 2020-21.

Table 1: Area, production and productivity of major oilseed crops in India (2020-21)

| Sr. No. | Crop | Area(mha) | Production (mt) | Productivity (kg/ha) |
|---------|------------------|-----------|-----------------|----------------------|
| 1 | Soybean | 12.91 | 12.61 | 976 |
| 2 | Mustard/Rapeseed | 6.69 | 10.21 | 1524 |
| 3 | Groundnut | 6.01 | 10.24 | 1703 |
| 4 | Sesame | 1.72 | 0.81 | 474 |
| 5 | Castor | 0.88 | 1.64 | 1856 |
| 6 | Sunflower | 0.22 | 0.22 | 1011 |
| 7 | Niger | 0.13 | 0.04 | 317 |
| 8 | Linseed | 0.17 | 0.11 | 637 |
| 9 | Safflower | 0.05 | 0.03 | 640 |
| 10 | Oilseed all | 28.83 | 35.94 | 1247 |

Table 2: Area, production and productivity of major oilseed crops in Gujarat (2020-21)

| Sr. No. | Crop | Area (lakh ha) | Production (lakh tonnes) | Productivity (kg/ha) |
|---------|------------------|-------------------|-----------------------------|----------------------|
| 1 | Groundnut | 21.62 | 41.33 | 1911 |
| 2 | Castor | 6.52 | 13.45 | 2060 |
| 3 | Mustard/Rapeseed | 2.14 | 4.24 | 1976 |
| 4 | Sesame | 1.73 | 0.82 | 473 |
| 5 | Others | 1.52 | 2.03 | 1335 |
| 6 | Total oilseeds | 33.56 | 61.88 | 1844 |

Out of all oilseed crops soybean had the highest area under cultivation and production and castor had the highest productivity in India. While in Gujarat, groundnut had highest area under cultivation and production and castor had highest productivity in 2020-21.

In general oilseed crops are grown as a sole crop. Cultivating oilseed crops as a sole crop with wide spacing is usually found to be risky and less remunerative because of uncertainty of climatic condition of India. With intercropping in oilseed crops we can obtain higher profit and stabilized yield advantage, especially under adverse weather condition.

The basic concept of intercropping system involves growing together two or more crops with the assumption that two crops can exploit the environment better than one and ultimately produce the higher yield because the component crops differ in resources use and when grown together, they complement each other and make overall better use of resources. The practice leads to some benefit like yield advantage by utilizing resources efficiently and increases the productivity as compare to sole cropping system over the different season.

Cropping system

Cropping system represents cropping patterns used on a farm and their interaction with farm resources, other farm enterprises and available technology which determine their makeup.

Cropping pattern refers to yearly sequence and spatial arrangement of crops and fallow on a given area. When cropping pattern comes under specific management practices with available farm resources then it said to be cropping system.

Cropping system = cropping pattern + management

Cropping pattern is general term used for large area while cropping system is integrated term and used for small area or particular farm. Cropping pattern only depend on soil and climatic condition of given area while cropping system also depends on farmers social and economical status.

Types of cropping systems

- 1. Sole cropping:** Sole cropping refers to growing of only one crop or variety in pure stand at normal density in one farming year.
- 2. Monocropping:** Mono cropping refers to repetitive growing of only one crop in same pieces of land year after year.
- 3. Multiple cropping:** Multiple cropping refers to growing of two or more than two crops on same piece of land during one farming year. Multiple cropping further divided into intercropping, sequence cropping and ratoon cropping.

Intercropping

Intercropping is defined as a growing of two or more than two crops simultaneously on the same piece of land with a definite row arrangement or in fixed ratio. It is intensification of cropping in time and space dimension.

Objectives of intercropping

- ✓ To utilize the space between two rows of main crop.
- ✓ Provide insurance against total crop failure under aberrant weather conditions or pest epidemics.
- ✓ Judicious utilization of resources such as land, labour and inputs.
- ✓ Increase in total productivity per unit land area.

Principles of intercropping

- ✓ Crops which are selected in intercropping should have complementary effects rather than competitive effects.
- ✓ Intercrop should be of shorter duration and of faster growing habits.
- ✓ Crops which are selected in intercropping should have similar agronomic practices.
- ✓ Erect growing crops should be intercropped with cover crops as well as non-legume crop should be intercropped with legume crops.
- ✓ The component crops should have different root depths.
- ✓ Select crops as per characteristics and constraints of soils.

Types of intercropping

- 1. Mixed intercropping:** Mixed intercropping defined as a growing of two or more crops simultaneously on the same piece of land in a proportion without any distinct row arrangement. This type of intercropping mostly followed in forage crops. *e.g.*, Lucerne + chicory.
- 2. Row intercropping:** Row intercropping refers to growing of two or more crops in the same piece of land simultaneously with definite row arrangement. *e.g.*, Funnel + cabbage (1:1).
- 3. Strip intercropping:** Strip intercropping refers to growing of two or more crops simultaneously in different strips which is wide enough to permit independent cultivation but narrow enough to allow interaction between different species. This type of intercropping mostly followed for reducing soil erosion in which one strip of erosion resisting crop like chickpea, groundnut, cowpea, etc. and another strip of erosion permitting crop like maize, sorghum, etc. are grown in alternate manner.
- 4. Relay intercropping:** Relay intercropping defined as a growing of two or more crops in the same piece of land simultaneously during part of the life cycle of each. The second crop is planted before the first crop mature. *e.g.*, intercropping of summer green gram and castor.
- 5. Parallel intercropping:** Under this intercropping, two crops are selected which have different growth habit and have a zero competition between each other and both of them express their full yield potential. *e.g.*, castor + groundnut.
- 6. Companion intercropping:** Growing short duration crop like mustard, potato, onion between sugarcane rows such that it is harvested before elongation phase of sugarcane (it is intercropping in sugarcane).
- 7. Multilevel intercropping:** Growing of two or more crops simultaneously in a same piece of land which have different growth habit, differential rooting pattern and above ground architecture. *e.g.*, Banana + brinjal + groundnut
- 8. Synergetic intercropping:** Under this intercropping system, yields of both crops are higher than of their pure crops on unit area basis. *e.g.*, Sugarcane + potato.

Type based on percent of plant population used for each crop in intercropping

Additive series intercropping:

- ✓ In such type of intercropping, one crop is main crop or base crop and another crop is intercrop.
- ✓ The plant population of base crop is kept same as recommended population in pure stand whereas that of intercrop is less.
- ✓ Intercrop is introduced into the base crop by adjusting or changing crop geometry, *i.e.*, addition of intercrop to the base crop.
- ✓ This type of intercropping is mostly followed in India.

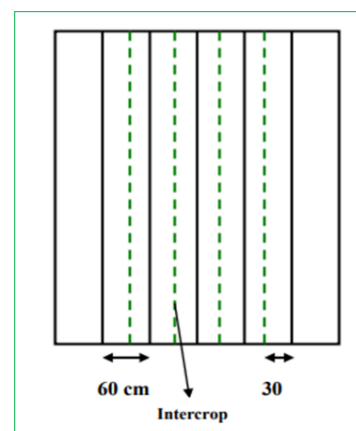


Fig. 3: Additive series intercropping

Replacement series intercropping:

- ✓ Both the crops are component crops. Neither is the base crop nor is the inter crop.
- ✓ It means the plant population of both component crops is less than their recommended population in pure stand.
- ✓ Component crop is introduced by replacing row of another component crop.
- ✓ This type of intercropping is widely adopted in western countries.

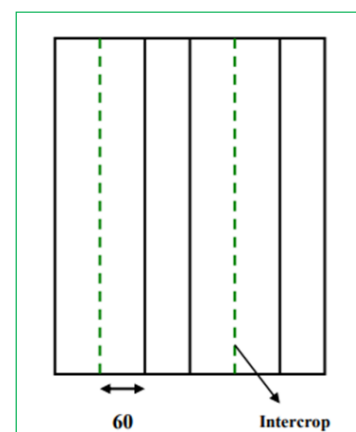


Fig. 4: Replacement series intercropping

Important requirements for successful intercropping

- ✓ The time of peak nutrient demands of component crops should not overlap.
- ✓ Competition for light, CO₂ and water should be minimum among the component crops.
- ✓ Complementarily should exist between the component crops.
- ✓ The differences in maturity of component crops should be at least 30 days.

Advantages of intercropping

- ✓ Additional yield is obtained from component crop.

- ✓ If the main crop is damaged due to unfavorable conditions like drought, flood, epidemics, etc. component may give substitute income. So, it is practiced as an insurance against crop failure under adverse condition.
- ✓ Additional care is not needed for the component crop because principal crop supplements the requirement of the companion crop.
- ✓ Helps to restore soil fertility, if legumes are included as inter crops.
- ✓ Quick growing cover crops suppress the harmful weeds thriving in the inter-spaces of the main crop as well as suppress soil erosion.
- ✓ Utilizes growth resources efficiently and productivity is increased.

Disadvantages of intercropping

- ✓ Yield decreases because of adverse competition effect.
- ✓ Productivity of intercropping system may reduce if allelopathic effect prevailing between intercrops.
- ✓ Creates interference in the free use of machines for intercultural operations.
- ✓ Higher amount of fertilizer or irrigation water cannot be utilized properly as the component crops vary in their response of these resources.
- ✓ Harvesting is difficult.

Following feasibility of intercropping in oilseed crops is mentioned based on field trials conducted at different places in India.

| | | |
|-----------------------------|-------------------------------------|---------------------------------|
| Castor based | Groundnut based | Soyabean based |
| Castor + Cluster bean (2:4) | Groundnut + Sesame (4:2) | Soyabean + Pigeon pea (5:1) |
| Castor + Groundnut (1:2) | Groundnut + Pigeon pea (2:1) | Soyabean + Maize (2:1) |
| Castor + Lucerne (1:2) | Groundnut + Foxtail millet (6:1) | Soyabean + Foxtail millet (4:2) |
| Castor + Green gram (1:2) | Groundnut + Sweet corn (2:1) | |
| Castor + Onion (1:12) | Groundnut + <i>Bt.</i> cotton (3:1) | |
| Sesame based | Linseed based | Niger based |
| Sesame + Cluster bean (1:2) | Linseed + Sorghum (2:1) | Niger + Pigeon pea (3:1) |
| Sesame + Cotton (3:1) | Linseed + Safflower (2:1) | |
| Sesame + Green gram (3:2) | Linseed + Chickpea (1:5) | |
| Sesame + Black gram (8:2) | | |
| Sesame + Proso millet (1:2) | | |

| Mustard based | Sunflower based | |
|--------------------------|-------------------------------|--|
| Mustard + Lentil (1:6) | Sunflower + Black gram (1:1) | |
| Mustard + Chickpea (1:3) | Sunflower + French bean (2:2) | |
| | Sunflower + Groundnut (1:1) | |

Conclusion

From the foregoing discussion, it can be concluded that intercropping in oilseed crops with having specific ratio gave significantly higher equivalent yield than sole cropping. Intercropping of oilseed crops with the nitrogen fixing crops like castor with groundnut, cluster bean and Lucerne; sesame with green gram, cluster bean and black gram; mustard and linseed with chickpea; sunflower with black gram and groundnut enhance crop equivalent yield and land equivalent ratio by efficiently utilizing available resources that directly increase farmer revenue by overall production.

Reference

- Anonymous. (2021). Ministry of Agriculture and Farmers Welfare, Government of India (ON1704). www.indiastat.com.
- Choudhuri P, Jana JC. Growth, yield, quality and economic impacts of intercropping in potato. *Agricultural and Biological Sciences Journal*. 2005;1:6-9.