e-ISSN:2321-6182
p-ISSN:2347-2332

Research & Reviews: Journal of Pharmacognosy and Phytochemistry

Dynamics of oilseeds in India: An overview

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Review Article

Received date: 07/05/2001
Accepted date: 01/05/2021
Published date: 08/06/2021

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Keywords: Oilseeds; Stress; Improvement; Farmers

ABSTRACT

Oilseeds are the second most important determinant of the agricultural economy, after grains in the field crop segment. Total oilseed production in the country in 2018-2019 is estimated at 31.50 million tons, which is slightly higher than the production of 31.31 million tons in 2017-2018. During the last decade, the growth of edible oil imports has been around 174%. The per capita consumption of oilseeds is rising continuously 19.30 kg/year during 2017-18. Defective agronomic practices, a high incidence of abiotic and biotic stress are the reasons for the low overall productivity of oilseeds in the country. Genetic improvement, as well as the best packages and practices and their adoption in larger areas by farmers, will undoubtedly be a step forward to achieve self-sufficiency in oilseeds.

INTRODUCTION

Oilseeds are the second most important determinant of the agricultural economy, after grains in the field crop segment. The self-sufficiency in oilseeds achieved during the "yellow revolution" in the early 1990s could not be sustained beyond a short period. India has incurred $ 10.8 million lasting 2016-17 in the import of edible oils to accumulate with the requirements of edible oils. India's vegetable oil economy is the fourth largest in the world after United States, China and Brazil. Oilseeds represent 13% of the Gross crop area, 3% of gross national product and 10% of the value of all agricultural products. With low levels of use of inputs for oil crops, their productivity is stagnates around 1.0 t ha-1. Almost 72% of the total the oilseed area was limited to cultivated rain fed agriculture mainly for marginal agricultural farmers.

LITERATURE REVIEW

The production and productivity of most oilseeds, as well as the availability of vegetable oils in India, are greatly influenced by the nine annual oil crops. There are two major sources of Oilseeds i.e. Primary and Secondary as in **Table 1**.

Status of oilseed crops in India

Oilseed cultivation is carried out throughout the country on approximately 26.00 million hectares, covering 72% of rain fed areas and producing approximately 30.00 million tons of oilseeds. Nine oilseeds are the main sources of vegetable oil in the country. Among the nine main oilseeds, soybeans (42%), groundnut (19%) and rapeseed and mustard (24%) represent more than 85% of the country's total oilseed area as in **(Figure 1)**. However, in terms of yield production, rapeseed, and mustard, soybeans and peanuts contribute 26%, 34%, and 29%, respectively as in **Tables 2 and 3**.

Total oilseed production in the country in 2018-2019 is estimated at 31.50 million tons, which is slightly higher than the production of 31.31 million tons in 2017-2018. However, oilseed production in 2018-2019 is 1.85 million tons higher than the average oilseed production.

The productivity gains in each of the oilseed crops are mainly due to the adoption of better technology by farmers.

e-ISSN:2321-6182
p-ISSN:2347-2332

Table 1: Classification of oilseeds.

Primary oilseeds	Secondary oilseeds
Edible group–Groundnut, Rapeseed and Mustard Soybean, Sunflower, Sesame, Safflower and Niger.	**Edible group** a) Seasonal crops-Cottonseed and Rice bran. b) Plantation crops -Coconut and Red-oil palm. c) Tree borne crops-Sal seed and Mahua
Non-edible group-Castor and Linseed.	**Non edible group** a) Seasonal crops-Mesta seed and Tobacco seed b) Plantation crops-Rubber seed c) Tree Borne crops–Neem and Karanj.

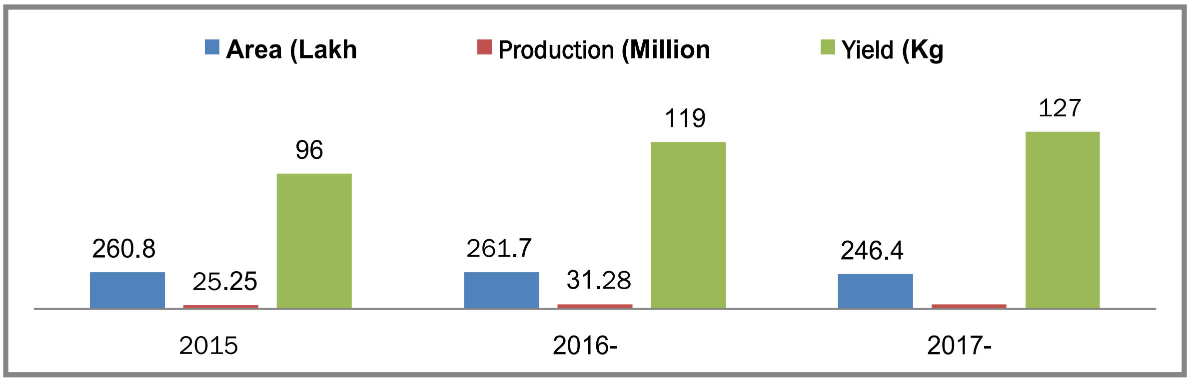

Figure 1. Area, production and yield scenario of oilseeds in India.

Table 2: State wise scenario of oilseeds in India.

State	Area ('000 ha)	Production ('000 tones)	Productivity (kg/ha)
Andhra Pradesh	819	1068	1304
Assam	312	209	670
Bihar	108	117	1085
Chhattisgarh	282	125	446
Gujarat	2725	5710	2095
Haryana	537	870	1620
Himachal Pradesh	12	6	525
JandK	60	38	633
Jharkhand	409	277	677
Karnataka	1215	812	668
Kerala	0.5	0.4	975
Madhya Pradesh	6641	6948	1046
Maharashtra	4207	4233	1006
Orissa	157	109	693
Punjab	49	70.2	1410
Rajasthan	4161	6064	1457
Tamil Naidu	392	956	2438
Telangana	371	603	1625
Uttar Pradesh	1099	1158	1054
Uttarakhand	29	27	931
West Bengal	932	1053.3	1130

Table 3: Area, production and yield of oilseed crops in Indian (2017-18).

S. No.	Area (000 ha)	Production (000 tones)	Productivity (Kg/ha)
Groundnut	4888	9253	1893
Castor	824	1568	1902
Linseed	326	174	533
Niger	218	70	321
Rapeseed and Mustard	5977	8430	1410
Safflower	82	55	613
Sesame	1580	755	478
Soya bean	10329	10933	1058
Sunflower	284	222	782

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Trend in oilseeds yield

The yield, which remained stable at 1,168 kg per hectare in the two years 2012-2014, decreased over the next two years, reaching 1,075 kg per hectare in 2014-2015 and 968 kg per hectare in 2015-2016. However, the trend has changed and the yield increased to 1,225 kg per hectare in 2015-2016. It should also improve and stand at 1,270 kg per hectare in 2017- 18 as in **Figure 2**. It should be noted that the yield that increased at an annual compound rate of 1.2% during the five years 2012- 13 to 2016-17 is expected to increase at a compound annual rate of 3.6% during the next five years 2017-18 to 2021- 2022 [1].

This would require strict adherence to the strategies proposed in the program and a considerable effort on the part of the government to increase the yield of oilseeds.

Minimum Support Price (MSP) of oilseeds

The government is trying to encourage national oilseed production not only by imposing import duties on edible oils, but also by raising the minimum support prices (MSP) for oilseeds **(Figure 3)**. However, increasing the MSP does not always solve the problem because farmers have to sell their crops in markets where oilseed prices fluctuate depending on the supply and demand situation. Soybeans, rapeseed, and groundnut were sold at a price lower than the MSP and their prices fell between 20 and 30% per year, according to the July 2017 notification from the Association of Solvent Extractors (SEA). Public procurement must be carried out to stabilize prices under the price support program (PSS). However, sometimes there is no guaranteed purchase of oilseeds by the government at MSP and this exacerbates the problem for farmers. According to the National Federation of Marketing of Agricultural Cooperatives of India (NAFED), the federation bought 2.22 lakh tons of oilseeds, while oilseed production in 2016-2017 was 31.3 million tons. This implies a marginal supply of 0.7%of the oilseeds produced in 2016-2017. Poor and guaranteed supply amidst fluctuating oilseed prices is a barrier and discourages farmers from producing more oilseeds, which in turn restricts the national production of edible oil [2].

Oilseed sector in India

The domestic demand for edible oils and fats has increased quickly at an annual rate of 6%, for internal production it has increased by only 2% per year. More than half of consumption is met through sections of imported and three-fourth of these edible oils, imports are made from Indonesian palm oil and Malaysia [3]. The gap between offers asked it mainly extends to lower oil production seeds and change of surface to other crops. He continued increasing the gap between demand and supply of edible oils. Over the years it has forced India to make a large import of groceries oils that caused considerable drainage in currencies.

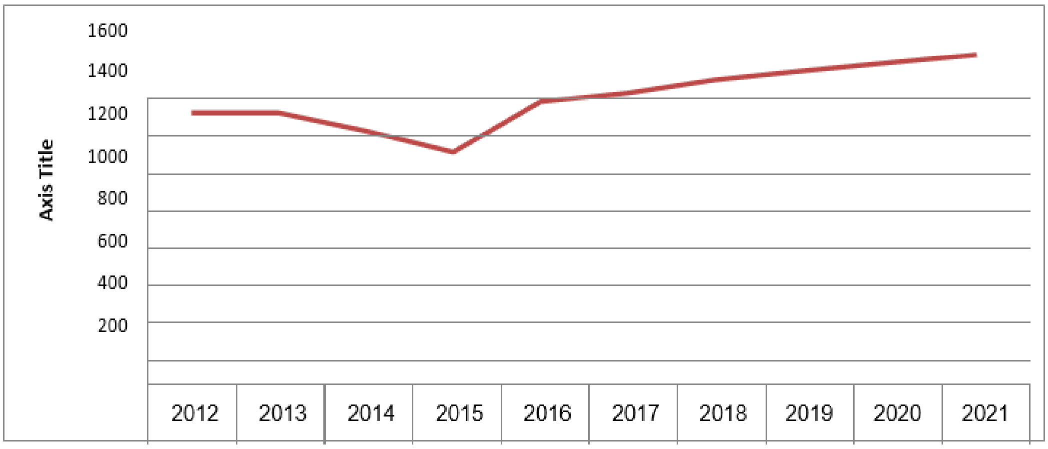

Figure 2. Trends in oilseeds.

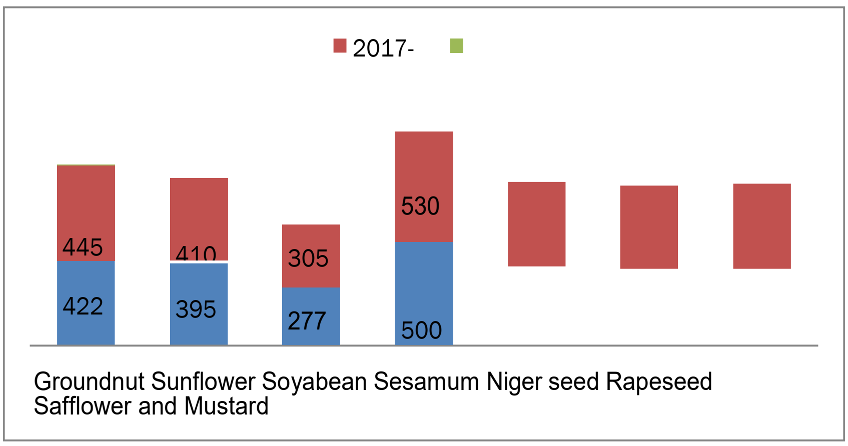

Figure 2. Trends in oilseeds.

The amount of imported edible oils is 4.3 MT around 4320 million rupees in 2000-01 which increases at 15 MT with a cost of Rs 65,000 million in 2015-16. The government interventions in the past like technology Oilseed Mission, 1986 have not provided improvement results due to supply side limitations. The rich agro biological diversity of India is favourable for the production of all oilseeds. But, crop productivity Very low edible acesites even with price support policies. In addition, the growing importation and stagnation of national production often attributed to trade liberalization policies [2].

Demand and supply of vegetable oils in India

India relies heavily on imports to meet its needs for edible oils and is the largest importer of vegetable oils in the world, followed by China and the United States. Of all imported edible oils, the proportion of palm oil is around 60%, followed by 25% soybean oil and sunflower oil (12%). During the last decade, the growth of edible oil imports has been around 174%. The import figure of edible oils during 2017-18 reveals that India imported a total of 15.35 million tonnes of vegetable oils costing Rs. 74996 crore. The percapita consumption which was 15.80 kg per person per annum during 2012-13 increased to 19.30 kg per person per annual in 2017-18 as in **Table 4**.

Constraints in oilseed crop production in India

- Although these oilseeds are energy-rich crops that require higher inputs with better management practices, more than 85% of the area cultivated with oilseeds is rain fed and is cultivated under conditions of energy starvation with low inputs and poor management practices because the total genetic potential of the crop remains unexploited, which explains the large fluctuations and implies a high risk.

- Due to the greater importance given to field cereals, progress has not been substantial and these crops are generally grown in marginal and submarine areas where the fertility of the land is low to cultivate field grains, so farmers use these crops only to keep the land fallow.

Similarly, these crops are generally grown by marginal farmers in areas not irrigated with poor management practices. Similarly, the input application rate is very low and farmers are also not adapted to new technologies and, due to the decrease in land ownership, mechanization has not been so popular.

- These crops are very affected by pests and diseases. Pests such as aphids and diseases such as powdery mildew, rust cause production losses of up to 50%.

- There has been no adequate transfer of technology from the laboratory to the farm. The supply of technology and inputs desired by agricultural institutions to farmers is very low.

Corporeal constraints in oilseeds

Phenology: The development of a crop of oilseeds throughout the growing season can be characterized according to the time of the main phenological events, such as the appearance of seedlings, the beginning of flowers, the beginning of stem extension, the appearance of the first open flower, cessation of flowering and maturity. Selecting a cultivar for a short season environment would imply adjusting developmental responses to the temperature and duration of the day. All Brassica napus spring cultivars are essentially optional long-day plants, that is, the flowering period is shortened byan increase in the day. However, the responses to the photoperiod of spring cultivars of B. napus depend on temperature [3] and can flourish quite quickly in short days (<12 hours) provided temperatures are low. This interaction between the temperature and the photoperiod to determine the time of floral initiation offers considerable development possibilities in cultivars closely adapted to specific environments.

Production and distribution of dry matter: The timing of flowering (or initiation of the flower) is crucial to determine the yield of the seed, although it is also important to avoid environmental stress in spring cultivars. The growth of the vegetation cover before an optimal flowering period should provide an assimilated source of sufficient amplitude to be fully exploited during reproductive development. The yield of the seed will then depend on the efficiency with which the stored assimilates and the current ones are used in the development of the seeds. The pattern of inflorescence development will be an important limiting factor that will influence this effectiveness in oilseeds.

Table 4: Demand and Supply of vegetable oils in India.

S. No.	Area (000 ha)	Production (000 tones)	Productivity (Kg/ha)
Groundnut	4888	9253	1893
Castor	824	1568	1902
Linseed	326	174	533
Niger	218	70	321
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e-ISSN:2321-6182
p-ISSN:2347-2332

Carbon/nitrogen metabolism: Differences were detected in cultivars for yield under limited nitrogen supply and yield response to an increase in the levels of nitrogen applied. Differences in the rate of nitrogen absorption were observed only at intermediate levels of nitrogen and in the efficiency of nitrogen use by the plant at low levels of nitrogen. Although the rate of nitrogen absorption correlated with the size of the root system, it was evident that the cultivars also differed significantly in their ability to absorb nitrate from the soil or culture in solution.

Relationships between performance components: Analysis of genetic and environmental variations in cereal crop yields have often involved the distribution of yield in a series of simple morphological components, such as the number of pods per plant (or per unit area), the number of seeds per pod and weight per seed. These components develop sequentially overtime and are, to some extent, interdependent. Such a pattern of development is often characterized by negative correlations between performance components that are developmental rather than genetic. The pattern of sequential development of the yield components means that the extent to which the first component of the sequence (e.g., Pods per plant) uses a limited metabolic intake will determine the expression of subsequent developing components (e.g. number of seeds per pod and seed size). The interdependence of these sequential components could well be amplified by an oscillatory contribution of metabolites that imposes limits of critical stages in the development sequence.

Soyabean

- Drought stress is a major constraint to the production and yield stability of soybean. For developing high yielding varieties under drought conditions, the most widely employed criterion has traditionally been direct selection for yield stability over multiple locations. However, this approach is time consuming and labour intensive, because yield is a highly quantitative trait with low heritability, and influenced by differences arising from soil heterogeneity and environmental.
- Complete inundation at the early seedling stage is a common environmental constraint for soybean production throughout the world.
- According to MoFA (2006), soybean is harvested when 90% of the pods turn yellow or are dry. Delaying harvesting beyond this period leads to shattering of seeds, especially in late-planted soybean, the seeds of which are ready when the weather is completely dry.

Rapeseed and mustard

- Flowering and grain filling are the most sensitive stages for temperature stress damage probably due to vulnerability during pollen and grain development, anthesis and fertilization leading to reduce crop yield. High temperature in Brassica enhanced plant development and caused flower abortion and poor grain filling with appreciable loss in seed yield. A rise of 30°C in maximum daily temperature (21-24°C) during flowering and grain filling caused a decline of 430 kg/ha in canola seed yield.
- The low yield potential of mustard is due to 30 to 50% of mustard flowers do not develop into mature pods. It means potential fruit or seed number is usually much larger than the number actually produced by the plant community. During the reproductive stage; the flowering, fruiting and vegetative growth occur simultaneously until physiological maturity. Therefore, developing reproductive sinks are competing for assimilates with vegetative sinks.

Groundnut

The Groundnut which is also popularly known as peanut is one of the world’s most popular and universal crops, cultivated in more than 100 countries of six continents.

- Pest and disease incidence are the major thread in groundnut production which causing more than 25 per cent of yield loss. Leakage of solutes as a consequence of membrane damage is a common response of groundnut tissue to several types of stress including low or high temperatures, low soil moisture or high soil salinity. There is much evidence indicating that calcium is required to maintain membrane integrity.
- Bhagsari et al. (1976) observed large reductions in photosynthesis and stomatal conductance as the relative water content of groundnut leaves decreased from 80 to 75%. The main effect of soil water deficit on the leaf carbon exchange rate is exerted through stomatal closure.

Sunflower

The major physiological constraints in sunflower production are excessive vegetative growth, lack of photosynthetic activity during the time of seed filling, poor translocation of photosynthates and poor seed set in the cultivated hybrids Maintenance of less leaf area duration during post-anthesis period leads to decreased dry matter production, harvest index and seed yield.

Sesamum

Sesame has the ability to overcome drought by developing an extensive rooting system, although it experiences substantial yield losses if drought occurs when it is cultivated on marginal and low rain fed areas. The effect of drought is more pronounced on sesame seed yield than other morphological characters.

Safflower

The prevalence of hot and dry conditions during the maturity phase influenced the rate of photosynthesis, nitrogen assimilation, and the sink size of safflower seeds. As a result, biotic and abiotic stresses diminish photosynthesis and crop nitrogen uptake limiting safflower production [4].

Niger

Self-incompatibility has hindered the improvement of the crop by conventional plant breeding techniques and revealed difficulty for the development and maintenance of inbred lines. During the process of adaptation to a water-deficit condition, the plant experiences osmotic stress due to production of toxic reactive oxygen species (ROS), which affects the plant's homeostasis [5-7].

Castor

The initial constraints in improving castor were its seed shattering (dehiscent) nature, late duration and low yield, frost and drought susceptibility, indeterminate growth habit and susceptibility to large number of insects and diseases.

Linseed

Harvesting can be a major problem with linseed, particularly if the crop is late, incompletely desiccated or lodged.

Future challenges and strategies to increase oilseed production

The growth rate of oilseed production is lower compared to the internal demand of people in India and the limited availability of agricultural land for the population, and irrigation shortages are the other factors to consider. The production of oilseed crops in India is much lower than in other developed countries. The mayor emphasizes sustainable agriculture and economic liberalization through the General Agreement on Trade and Tariffs (GAIT) guarantees solid strategies to ensure the overall sustainability of oilseed production systems to meet demands. In this context, the adoption of the main strategies will contribute greatly to the country's self-sufficiency in plant aces [8-10].

The minutes of a national brainstorming session in which all parties involved participated identified the following research and development strategies to increase oilseed production and the availability of vegetable oils or the country.

Investigation

- Efforts to develop high yield crops with desirable quality parameters for different agro ecological regions and limitations, using the germ plasm available to intensified.
- Integrate modern biotechnological tools such as molecular markers, marker-assisted selection (MAS) and transgenic genetic improvement complementary to conventional improvement and adopt the varied ranges of products to develop crops with resistance incorporated into biotic stress and wide capacity of acoustic switching amplitude.
- High-oil corn is potential source of supplemental vegetable oil from the corn industry, but it needs the development of high-yield varieties of oil with moderate loss of grain yield. Promote quality protein corn (QPM) for the poultry industry Development
- Guaranteed supply of better quality seeds.
- Therefore, the proportion of seed reuse to at least 20% for varieties and 100% for hybrids.
- Adoptefficientdryfarmingtechnologiesspecifictodrought-prooflocationandsustainableoilseedproduction. Integrate the production of olive oil seedlings with the hydro graphic program for the whole body and the world.
- Promote the method of planting in wide beds and furrows to obtain two benefits of moisture conservation and the elimination of excess moisture.

Other strategies

A Large-scale intercropped oilseed crops: This section talks about the possible crop intercropping with the main crops in different regions and also offers assistance for interleaved crops of Rs 3,000 to Rs, 5,000 per hectare depending on the type of crop interspersed.

Oilseed cultivation in areas and seasons and non-traditional states: Here, the agenda highlights the scope of the introduction of different oilseed crops in different areas at different stations in non-traditional areas and stations. For this, the state departments and the state department of agriculture must participate.

Extension of the Targeting Rice Barlow Area (TRFA) program beyond six eastern states: Some areas remain fallow (they are not sown). Cultivation of long-lived rice varieties, water saturation and excessive humidity in the Tal areas, lack of moisture when planting winter crops, lack of irrigation, lack of availability of seeds of short varieties. Duration of rabbi crops and other socio-economic problems, such as street cattle and blue bulls, etc. There are several reasons attributed by the National Oilseed and Oil Palm Seeds Mission (NMOOP) for certain fallows areas. To use these areas, the objective of the agenda is to cover an area of

18.50 lakh hectares with an additional production of 13.50 lakh tons of legumes and oilseeds within which 5,000 villages in 50 districts will be included for promotion of legumes and oilseeds during the rabi season in six eastern states during 2018-19.

e-ISSN:2321-6182
p-ISSN:2347-2332

Table 11: Result of post compression evaluation parameter.

Formulation	Hardness (kg/cm2)	Weight variation	Friability (%)	Assay (%)	DT(sec)	%DR (30min)
F1	3.5	Pass	0.77	94.23	255	54.76
F2	4	Pass	1.78	92	240	58.43
F3	3,5	Pass	0.78	93.5	130	60.23
F4	4,5	Pass	0.7	95.82	264	100.04
F5	3.5	Pass	1.2	95	131	64.88

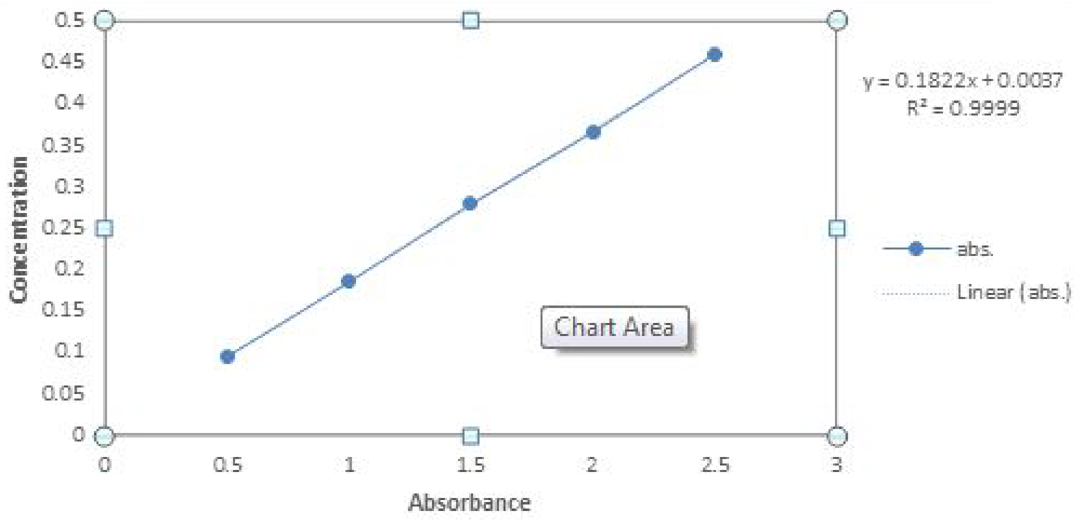

Figure 3. Standardization of calibration curve.

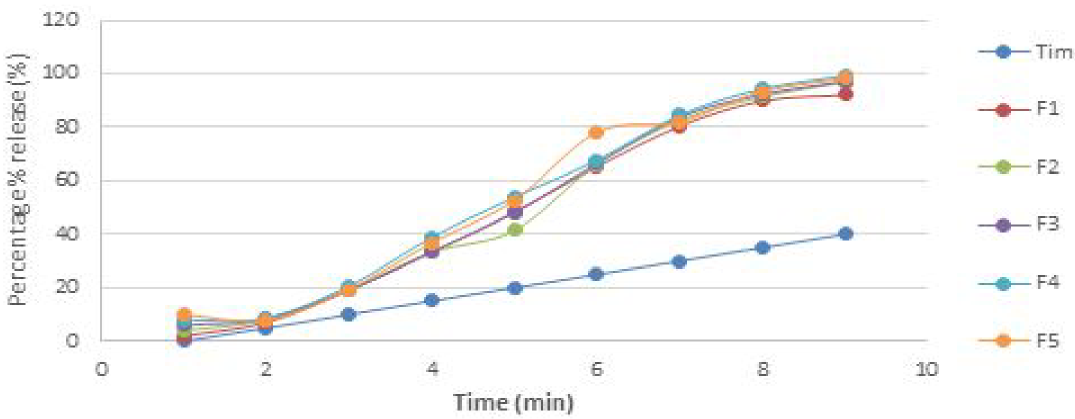

Figure 4. Percentage of drug release.

Central agencies will supply approximately 80,000 leguminous mini kits and 40,000 oilseed mini kits. Besides, it proposes to increase the TRFA in the states of Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra, Gujarat, NE and the Himalayan states where there is a large area of fallow rice are available [11-14].

DISCUSSION AND CONCLUSION

Understand the metabolic pathways of oilseeds: Oilseeds plants are an important renewable source of fatty acids because they accumulate them as triacylglycerol (TAG) as the main storage components in seeds. In plants, de novo synthesis reactions of fatty acids begin in plastids and are then exported to the cytoplasm following two interdependent metabolic pathways: an acyl-CoA-dependent pathway and an acyl-Coo-independent pathway. On the dependent route, commonly known as the Kennedy route, the onset and extension of nascent acyl chains require acetyl and malonyl-CoA respectively, as direct precursors of up to eighteen carbons in length. In the acyl-CoA independent pathway, an alternative enzymes used for the final acylation reaction, called Phospholipid: Diacylglycerol Acyltransferase (PDAT). PDAT directly transfers anacyl group of phosphatidylcholine (PC) to DAG, producing TAG. The stages of desaturation of fatty acids are catalyzed by desaturases of the stearoyl-acyl Plastid Carrier Protein (PCR). After termination, free fatty acids are activated in CoA esters, exported from plastidial and assembled into glycerolipids in the Endoplasmic Reticulum (ER).

However, during the last decade, scientists have realized that manipulating unique genes only has limited value to alter metabolic pathways. Today, there are strategies focused on more complex approaches that involve the overexpression or simultaneous suppression of several genes to obtain an optimal metabolic flow. Understanding a metabolic network would facilitate the

e-ISSN:2321-6182
p-ISSN:2347-2332

production of natural products and the synthesis of new molecules in a predictable and useful way. For this reason, the metabolic engineering of oilseed plants has attracted industrial and academic researchers in recent decades.

REFERENCES

1. Bhagsari AS, et al. Effect of moisture stress on photosynthesis and some related physiological characteristics in peanuts. Crop Sci. 1976;16:712–715.
2. Capell T, et al. Progress in plantmetabolicengineering. Curr Opin Biotechnol. 2004;15:148- 154.
3. Chahal KK, et al. Linseed: A multifaceted oilseed crop. Rashtriya Krishi. 2012;7(1):21-22.
4. Ghane S G, et al. Nikam Differential growth, physiological and biochemical responses of Niger (Guizotia abyssinica Cass.) cultivars to water-deficit (drought) stress. Acta Physiol Plant. 2012;34:215–225 .
5. Kroon JTM, et al. Identification and functional expression of a type 2 acyl-CoA: diacylglycerol acyltransferase (DGAT2) in developing castor bean seeds which has high homology to the major triglyceride biosynthetic enzyme of fungi and animals. Phytochem. 2006;67:2541-2549.
6. Kim K S, et al. Changes in leaf cuticular waxes of sesame plants exposed to water deficit. J Plant Physiol.2007;164:1134 – 1143.
7. Patro HK, et al. Optimization of kharif groundnut production under resource constraints. 2016;16(1):381- 383.
8. Chand R, et al. WTO and oilseeds sector, challenges of trade liberalization. Econ Polit Wkly. 2012;34(6):534–537.
9. Kennedy EP. Biosynthesis of complex lipids. Federation Proceedings.1961;20:934-940.
10. Patil B N and Dhomne M B. Influence of plant growth retardants on yield and yield contributing characters in sunflower. J Maharashtra Agric Univ. 1997;22(2):13-214.
11. Rathore SS, et al. Physiological and Stress Studies of Different Rapeseed mustard Genotypes Under Terminal Heat Stres. Int J Genet Eng Biotechnol. 2014;5(2):133- 142.
12. Boss WP, et al. Effect of divalent cations and polyethylene glycol on the membrane fluidity of protoplast. Plant Physiol. 1980;66:835–837.
13. Tamang BG, et al. Physiological and transcriptomic characterization of submergence and reoxygenation responses in soybean seedlings. Plant cell Environ. 2014;37(10):2350-65.
14. Koutroubas SD, et al. Seed filling patterns of safflower: genotypic and seasonal variations and association with other agronomic traits. Ind Crops Prod. 2010;31(1):7176.