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Growing seed

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Contents

AGRIALLIS
Science for Agriculture and Allied Sector: A Monthly e Newsletter
Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

AGRICULTURAL POLICIES OF PROFITABLE AGRICULTURE

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India basically depends on agriculture, over 58% of the population depends on Agriculture, in recent years, and there is a decreasing trend in the working people in agriculture. So many constraints like improper marketing facilities, water crisis, skill-less, which leads to a reduction in productivity, the efficiency of Agro-food products. Government is promoting agriculture in numerous ways like agricultural policies to remove the obligations regarding agriculture and majorly focused on the principle of profitability rather than the principle of productivity.

India is one of the fastest-growing economies in the world. It is having diversity in geography, economy and ethically. India accounts for 18% of the world population but having 0.15 ha per capita land, which leads to land-scarce for agriculture. Agriculture is the backbone of the Indian economy; it plays a very important role to boost up the national economy for decades. It is a key sector to contribute to both employment and GDP. In India, since 2011, production has been rising at an average of 3.6% annually. The economic growth of around 7% over the last 5 years makes India one of the fastest-growing economies.

But, somehow the contribution of the agriculture sector to GDP has continued in decreasing trend over two decades from 29% in 1990 to 17% in 2016. Indian Agriculture lags behind due to key challenges like Land fragmentation, long supply chain, risks in long term production, Water crisis, Improper linkage to downstream sectors, fewer opportunities for global value chains, etc.

To cope up with these problems, regulation or implementation of agricultural policies is needed. Agricultural policies are the set of laws relating to agriculture and imports of foreign agricultural products; usually, the government implement agricultural policies with the goal of achieving a specific outcome in the domestic product markets. It helps to upgrade the income and increase the standard of living of farmers within time-bound. Agricultural policies have remained a highly structural sector in India with government organizations;

Volume 3 – Issue 2
Online ISSN: 2582-368X
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Government has taken agricultural policies during the mid-1960s. Initially, it focuses on food self-sufficiency in staple food grains like rice and wheat, later on, years, it focuses on cultivated area, the introduction of land reforms, community development, minimum support price, public storage, procurement and distribution of food grains, etc. In India, the policies main aim is to remove the problems regarding agriculture and solve the complications related to improper and inefficient use of natural resources, the poor cost-benefit ratio of the sectorial activities, ineffective functions of cooperative farming, etc. These policies are formulated for all-round and comprehensive development of the agricultural sector.

Objectives of agricultural policies

- **Increasing the productivity of Inputs**

It is one of the most important objectives of the policy is to improve the productivity of inputs like wide yielding varieties, fertilizers, pesticides, irrigation projects etc.

- **Modernization in agriculture**

Introduction and invention of modern scientific technologies in agricultural operation and application in order to improve the agricultural input products.

- **Raising value added/hectare**

Increasing per hectare value added rather than raising physical output by raising the productivity of small and marginal holdings.

- **Protecting the interests of small/marginal farmers**

Protection of small and marginal farmers by removing arbitrators by using land reforms and providing institutional credit to support to farmers.

- **Yield enhancement of major commodities**

Production of major crops and livestock is less compared to other countries in the world. Increases in food production easily meet the country's population demand.

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

- **Agricultural research and training**

Encouragement for agricultural research and training by providing facilities in order to saturate the outcome of research among the farmers by creating a close link between research institutions and farmers.

- **Monitoring of environmental degradation**

Agricultural policy of India has set another objective to monitor environmental degradation of natural resources or base of agriculture.

- **Removing bureaucratic obstacles**

To remove the bureaucratic obstacles on the farmers- cooperative societies and self-help groups to work independently.

Key challenges

Productivity lags behind other parts of the region: The large share of employment in agriculture compared to GDP contribution reflects the slow pace of structural transformation and the relatively low labour, productivity. Farm labor productivity growth is still in back position compared to China, Vietnam, Indonesia, etc., land productivity has been rising over the years. Average yields of major crops are still less compared to other countries. Agriculture has been slow because of labours low level of education and lack of skill.

Fragmented land use patterns: In India, Fragmentation of land goes on an increasing trend, whose average size is 1.15 ha and still less. This sector includes majority marginal and small scale farmers, nearly 85% of the operational holdings are less than 2 ha in India, 5% of farmers holding more than 4ha of arable land. Land tenure governance in India is very complicated both in legislation and organizational framework.

Supply chains are long and disintegrated: Gaps in the supply chains (Physical infrastructure and logistics) reduces the chances of the establishment of the efficient agri-food supply chain, market infrastructure also highly suffered due to unintended impacts of regulations in markets for agriculture produce. Limited connectivity and inadequate storage lead to post-harvest losses and effect the incentives to the produce. The highest postharvest losses have occurred in fruits and vegetables in 2015 are 4% and 16%respectively.

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

Linkages to input markets are so weak: Even thoughavailability, access, quality of farm inputs and services has been improved over theyears; their distribution across the different size categories of farmers remains same. Informal chains still present in the seed and fertilizer markets, about 60% of seeds are used to sown which are saved by farmers, only 39% of holdings use certified seeds and 9.8% of hybrid *seeds*. The cost of HYV in formal channels highly cost and small farmers cannot afford.

Linkage to downstream sectors is weak: Food processing and retail sectors have been growing fastly over the years, but major drawback is they are under privatisation. It requires more expenditure, infrastructure, high labour intensive, more capital intensive unorganized segment. Absence of adequate connectivity, improper information and marketing linkages.

Pressures on natural resources risk reducing long term production growth: Land degradation is the more effective throughout the country 37% of the total land area is affected by different types of degradation, improper application of fertilizers (time, quantity, and place) Chemical fertilizers contribute to greenhouse gases, water pollution and soil contamination. India also suffering from severe water crisis due to long gap between water supply and need, Poor water resources management, changing in precipitation patterns due to climate abnormalities. Total water demand will raise by 32% by 2050 due to population growth. Putting water reserves under pressure and causing ground water depletion

Food and nutritional insecurity: Significant proportion of the population is a risk of falling back to food insecurity under certain conditions; performance in terms of nutritional quality has been less strong. Incidence of poverty in India is goes on increasing.

Agricultural policies in India

Central government launched number of schemes such as Pradhan manthri krishi sinchayi yojana, Pradhan mantri fasal bhima yojana, Neem-coated urea,Soil health card and e-NAM. Now the major aim of agricultural policies to focus on the principle of profitability but not principle of productivity in case of farming.

Institutional and governance reforms: They are many reforms relating to agricultural marketing, warehousing, land leasing, contract farming etc., Replacing open ended subsidies with direct benefit transfers for fertlizers and seeds would not just help target the right end users in the system, but also encourages efficient and judicious application of these inputs.

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

Agriculture is the state subject, pastexperience shows that no agricultural development on the ground is possible without meaningful interventions by state governments, In addition to these are issues concerning revitalizing farm extension network, skilling youth for setting up scientific agro-food based enterprises promoting institutional credit structure, development of postharvest management and encouragement for farmers producing organizations.

Climate smart Agri technologies: Adaption and mitigation strategies to monitor climate changes challenges have to be at the fore foot of any agricultural policy. Research has to designed to suit local cropping patterns and promote sustainable farm management in means of soil, water and energy. A large gene pool is available in many crops which allows for selection, breeding and developing new varieties tolerant to stresses like biotic and abiotic. The rationale of climate smart agriculture(CSA)has to be appreciated by decision makers and stakeholders at all levels. DFI by 2022 is not achievable, without making farmers resilient to climate change impacts and promoting CSA practices that sustainably increase productivity and income.

Food and nutrition security: There can be no inclusive growth without nutrition security that would entail a shift in focus from calorie intake towards delivering nutrition. Neglected crops such as pulses and millets are fortunately now receiving attention, not only because of their high protein and nutrition characteristics, but also for their climate resilience and low carbon and water foot prints. Creating a potential a markets for growers of these smart crops. The government should move from a cereal-centric policy focused on subsidised procurement and distribution of rice and wheat to a diversified mix of nutritious millets and legumes. National nutrition mission helps in procurement, inclusion of millet-based products in midday meals programmes and additional incentives beyond support farm expert policy.

Stable farm export policy: India ranks second in overall agricultural production, next only to China. But the country's export basket hardly reflects its huge crop diversity and potential to generate a significant farm trade surplus. Without an open and stable farm export policy, there's no predictability for farmers to access global markets and obtain the best possible prices for their produce. The movement to high-value crops (in protected cultivation, wherever possible), developing and exploiting the market for organic produce, creating farm export clusters, complying with international food-safety requirements, and doing away with

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

multiple authorities for monitoring/regulating agricultural trade are the need of the hour. It calls for an aggressive agricultural trade policy.

Digital Agriculture as a backbone for modern farming: Use of ICT has been successfully tested for timely delivery of cropping, weather and price information to farmers. While the information on markets leads to better price discovery and enables producers to capture a higher proportion of the marketable value, delivery of advisory services through digital and social media platforms can take care of the inadequacies of traditional farm extension delivery systems. All these digital agriculture initiatives require a robust data infrastructure, which, when integrated with Aadhaar, will also make for a monitoring and evaluation system to track farmer incomes and implementation of various government programmes and subsidy-linked schemes. Private agri-business agencies should also be made meaningful partners in this endeavour.

An integrated value-chain approach: Farmers must be integrated into modern value chains that can raise their incomes and also minimize the risks arising from middlemen and markets. There should be integration of post-harvest, marketing and processing infrastructures, adding value and quality to the raw produce of farmers. Also, technologies suited to respective agro-ecologies need to be put in place here and demonstrated to growers whose produce can be aggregated through FPOs/FPCs.

Reforming market regulations and strengthening market functioning: Indian farmers are receiving prices which are lower than the prices prevailing on the comparable international markets. First and foremost efforts to deploy and implement reforms already designed, such as the new model APMC Act and e-NAM, could be reinforced including inter alia the rationalization of levies and fees and to provide recourse for both consumers and producers when faced with uncompetitive practices. Supply chain arrangements should be fostered which could help overcome deficiencies in the current market environment. Improve transparency on market conditions and prices and consider investing in a price observatory.

The Minimum Support Prices: Minimum Support Price (MSP) is a form of market intervention by the Government of India to insure agricultural producers against any sharp fall in farm prices. The minimum support prices are announced by the Government of India at the beginning of the sowing season for certain crops on the basis of the recommendations of the Commission for Agricultural Costs and Prices (CACP). MSP is price fixed by the

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

Government of India to protect the producer - farmers - against excessive fall in price during bumper production years. The minimum support prices are a guaranteed price for their produce from the Government. The major objectives are to support the farmers from distress sales and to procure food grains for public distribution. In case the market price for the commodity falls below the announced minimum price due to bumper production and glut in the market, government agencies purchase the entire quantity offered by the farmers at the announced minimum price. The government at Cabinet Committee level currently sets Minimum Support Prices (MSPs) for 24 agricultural commodities.

Pradhan mathri fasal bhima yojana (PMFBY): To provide insurance coverage and financial support to the farmers in the event of failure of any of the notified crop as a result of natural calamities, pests and diseases. Itstabilizes the income of farmers to ensure their continuance in farming and encourage farmers to adopt innovative and modern agricultural practices. It also ensures flow of credit to the agriculture sector. There will be a uniform premium of only 2% to be paid by farmers for all Kharif crops and 1.5% for all Rabi crops. In case of annual commercial and horticultural crops, the premium to be paid by farmers will be only 5%.PMFBY is a replacement scheme of NAIS(Shekhar,2016)

Pradhan manthri kisan samman nidhi yojana: Under the scheme an income support of Rs.6000 per year in three equal instalments will be provided to small and marginal farmer families having combined land holding/ownership of up to 2 hectares. State Government and UT Administration will identify the farmer families which are eligible for support as per scheme guidelines. The fund will be directly transferred to the bank accounts of the beneficiaries.

Farmers producing organizations: Mobilizing farmers into groups of between 15-20 members at the village level and strengthening farmer capacity through agricultural best practices for enhanced productivity, ensuring usage of quality inputs and services for intensive agriculture. Facilitating fair and remunerative markets, including linking of producer groups to marketing opportunities.

12.Contract farming: It involves agricultural production being carried on the basis of an agreement between the buyer and farm producers. The farmer undertakes to supply agreed quantities of a crop or livestock product. In return, the buyer, usually a company, agrees to buy the product, often at a price that is established in advance. Company also supports by

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

providing inputs.

Conclusion

India's agriculture was in critical condition by facing many multiple challenges. Government promoted Agriculture in all possible ways to mitigate the problems. The possible ways are agricultural policies; these policy directions will play a major role in India's success in food security for its high population, improving quality and standard of living of millions of small holders. Agriculture and food policy settings also need to proper arrangement for better results or to reflect the changing nature of agriculture role in a growing economy. The government aims to improve the prospects of small/marginal farmers, improve the effectiveness of food security measures. Profitable Agriculture and doubling of farmers income aims should fulfill only by 100% implementation of these agricultural policies which can reach upto village level. Otherwise, there will be a negative impact on farmers as well as the agriculture sector. The government aims at to make farmers income double by 2022 will achieved only proper policy-making and implementation. If we get success profitable agriculture then directly leads to fulfil of the goal "Doubling of farmers income".

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AGRIALLIS
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Volume 3 – Issue 2
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AGRO TECHNOLOGIES FOR SUSTAINABLE DEVELOPMENT OF RAINFED AND WATER SCARCE AREA

Article Id: AL202131

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India's total food production during 2020-21 is about 298.3 million tonnes. India attains self-sufficiency in food grain production, but still, we are importing some pulses as we are unable to meet the requirement of 25.5 million tonnes of pulses. The main reason for this is very less productivity in the agricultural field. About 58.5% of cultivated land is under rainfed farming. Increased productivity in this rainfed area makes India a self-sufficient country in food production. This can be achieved by applying novel agro-technologies like soil and water conservation techniques, alternative land use system, integrated approaches of crop management and drought management practices.

Agriculture is the primary source of livelihood in India, about 54.6 % of India's population engaged in agriculture and allied activities. Moreover, it accounts for 17.1 % of the countries gross value added for 2017-18. India's total geographical area is 328.7 m ha. Out of which, 140. 1 m ha is reported as Net sown area, and 198.4 m ha is the gross cultivated area. Out of 198.4 m ha, 115 m ha area is gross rainfed area. It is about 60% of gross cultivated area. And 83.4 m ha is gross irrigated area it accounts for only 40% of gross cultivated area. India stands first place among the rainfed agricultural countries of the world in terms of both extend and value of produce. The population of India is increased in geometric progression. In order to meet food security, productivity and production of the food grains should be elevated than the present production of 284.83 mt. But for increasing productivity, the main constraint is lack of irrigation facility. It is becoming a challenge for the government, Agricultural scientist and formers to increase the production at the water-scarce condition. Then new practice and technology should be a sustainable manner so that it should not hamper the existing nature in natural resources, and it should be available for future generations.

By utilising present practices and technology, our farmers are able to produce 281.37 mt of food grains. Out of which 114 mt of food grains are produced through rainfed

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

agriculture, which feeds 44% of the Indian population. Still, agricultural scientists have huge scope to invent new agro technologies for increasing food production. Some types of crops like nutria cereals, pulses and oilseeds are grown majorly through the rainfed condition. Itis reported that 42.64 mt of nutria cereals, 31.50 mt of oilseeds and 24.02 mt of pulses are produced in 2018. Among them, most are grown in rainfed farming. By looking above statistics, it is possible to increase India's food production through the application of newly developed technologies and farmers income can be doubled at the time of 2022.

Strategies for sustained food production in rainfed region

Rainwater, land and crop management are prerequisites for improved crop production in rainfed farming. Our national food production can be increased by increasing the productivity of crop in the rainfed area, and this increased productivity can be achieved by practising the same strategies which are discussed below.

1. Soil and rainwater conservation techniques:

For successful dryland farming, efficient conservation of rainwater and soil is essential. Construction of contour bunds, graded bunds, grassy waterways is essential to prevent excess runoff water. And the construction of these structures depends on rainfall intensity, the texture of the soil and slope of the land. Application of proper watershed technologies like the construction of farm pond, rainwater harvesting, convey the excess runoff water to form a pond. Prevention of excess evapotranspiration by mulching, intercropping and mixed cropping is mandatory.

Borewell recharge: it is the concept of underground recharge by allowing an excessive run of water to the aquifer, so that water source in the underground is maintained for several years.

2. Timely sowing of crops and tillage practices:

Maintenance of proper soil moisture is necessary for good germination and proper crop stand establishment. This can be achieved by practising proper tillage practices. Medium and shallow tillage is practised for dust mulching, incorporation of FYM and phosphate fertilizers. Deep tillage is beneficial under alluvial and red soil for increasing water intake and holding capacity. Use of seed cum fertilizer drillers plays a vital role in rainfed farming, as it maintains the proper distance between seed and fertilizer placement and looked

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

after soil cover over seeds and place the seeds and fertilizer at moisture zone so that proper germination and good crop establishment can be observed.

Timely sowing of crops helps in drought mitigation, and it helps in escaping pest, diseases and drought incidence.

Ex: terminal drought can be managed by early sowing and using short-duration varieties.

GPU-48 is short duration ragi variety complete is cropping period in 95-100 days.

3. Adaptation of improved varieties:

Use of drought-resistant crop varieties gives a stable production in rainfed farming. Formers should be aware of the use of drought-resistant high yielding varieties. And the use of hybrids in rainfed farming is not profitable, as it requires high nutrient and input supply for crop production and is not responsive to low water availability.

4. Use of efficient crop and cropping system:

Climate-resilient crops like neutri cereals are most suitable for rainfed farming. About 300 mm annual rainfall is sufficient for them to get a good yield. Moisture at germination and one or two life-saving irrigation or rainfall at seed setting is sufficient to reap good yield.

Based on the application of rainwater harvesting technology, soil depth, rainfall pattern, large rainfed areas can be put under intensive cropping system. That is, if annual rainfall is 750 mm with more than 30 weeks of effective growing season then double cropping can be effectively made.

Implementation of the mixed and intercropping system

In a rainfed area where annual rainfall is 500 to 700 mm mixed and intercropping should be employed to get higher returns to the farmers. Intercropping of cereals with legumes help in maintaining soil fertility, prevent moisture evaporation, helps in weed control, and effective land use can be made thereby legume supplement the yield of cereals.

Ex: sorghum + red gram, Pearl millet + Black gram, Maize + Soybean, Ragi + Red gram (8:1).

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

The rainfed area receiving more than 800 mm rainfall can effectively be used for sequence cropping. In Bundelkhand region of Madhya Pradesh rice-wheat, rice-chickpea, Sorghum-chickpea, green gram- wheat sequence cropping is carried out.

5. Integrated approach of nutrient management:

Rainfed farming not only suffers from water scarcity but also suffer from nutrient deficiency. And hence the integrated approach to nutrient management is necessary. Intercropping of legumes with cereal crop gives 20 kg of N per hectare and providing green manure like gliricidia, Leucaena, Sesbania, Daincha fulfil 50% of nutrient requirement. Incorporation of FYM and biofertilizers and biocontrol agents like Azospirulum, Azotobacter, Trichoderma, and Pseudomonas with soil helps in maintaining good soil health. The recommended dosage of inorganic fertilizer should be applied at the time of sowing with the help of seed cum fertilizer driller helps incorrect placement of fertilizer and prevent nutrient losses and increases nutrient use efficiency.

6. Alternate land-use system:

Due to the current weather condition, rainfed farming suffers from instability in production and farm income. To provide stability in the farm income alternate land-use system and use of marginal land for production of fuelwood, fodder and fibre should be implemented. For this integrating annual crops with a perennial component in order to utilise the off seasonal rainfall. This includes Agri-silviculture, Silvi-pasture, Agri-horticulture, Alley cropping etc. By using this livestock like sheep and goat rearing can be practised which supplement the form of income.

7. Agronomic practices for rainfed farming:

Practising of seed hardening process before sowing will help in good germination and proper crop establishment and gives resistant to crop against drought. Process of seed hardening can be done by soaking the seeds in water for 12 hours, followed by sun-drying for1 day then they are subjected to seed treatment and sowing.

Mulching should be done after sowing helps to prevent evaporation and weeds. Intercropping of legumes with cereals acts as mulching material. Shallow ploughing with cultivator while sowing act as dust mulching prevents excessive water loss from soil.

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

8. Drought management:

Drought can be defined based on meteorological, agricultural and hydrological criteria. When average seasonal rainfall in a region is less than 75% of the normal is called meteorological drought. If extended dry period results in insufficient moisture in the root zone of soil causing an adverse effect on crop such drought is known as agricultural drought. Hydrological drought is an extended dry period leading to substantial depletion of water sources.

Alternate crops for a different period of sowing that match the delay in sowing have been recommended to mitigate the effect of drought. Creating soil mulches, and minimizing weed population reduce evaporative loses, which extend the life of standing crops under drought. Mitigation of Agricultural drought is possible to some extent through alternate crop strategy, reduction in evaporative losses and better crop husbandry. Harvesting and storage of more rainwater in situ and in tanks can help in mitigation of droughts. Lifesaving irrigation from stored water under drought condition can save rainfed crops.

Conclusion

In India about 60% of cultivated land is comes under rainfed farming and Indians production can be increased by increasing the productivity of the rainfed area. This can be achieved by proper drought management practices, agronomic practices, rainwater harvesting, prevention of excess runoff water, borewell recharge, proper watershed management, use of climate-resilient crops like millets or nutria cereals, integrated nutrient management and integrated farming system. By proper application of these technologies helps in minimizing the constraints of rainfed farming.

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Volume 3 – Issue 2
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SPIRULINA CULTIVATION FOR MAKING PROFITABLE AND HEALTHY LIVELIHOODS

Article Id: AL202132

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Spirulina is multicellular and filamentous blue-green microalgae that can be consumed by humans and animals. The researchers called "Wonder Gift of Nature and The Future Nutritional Food" for human beings. Spirulina contains 55 to 70 percent of protein and rich in all the nutrients needed for daily growth. So, spirulina cultivation is gaining popularity among the people as a lucrative business.

Culture methods

Mother or pure culture

Healthy mother algae should be determining a good quality output and high yield. So mother algae to be obtained from Algae research centres, fisheries colleges and certified farmers only. Because it's necessary to avoiding contamination or mix with other microalgae.

Commonly grown spirulina species

- Arthrospira planters
- Arthrospira maxima
- Arthrospira fusiformis

Grow-out culture

The raceways flow-through system should be the best method of spirulina cultivation for commercial purposes. In this system, water is constantly circulating so that the nutrients in the water get to algae and prevent the algae from setting to the bottom of the tank. It's economically made profitable; the size should not less then 20×2×0.5m. Especially the depth should not be more or less than 0.5m. Then filling of water by using 40micron mesh cloths for preventing other algae contaminations. Then added with the recommended amount of

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

medium (chemical solutions) in tanks. After applying medium, the mother algae to be added to tanks. The ratio of mother algae in tanks 1:100litres of water.And cell volume >25000cells /ml.

Fertilizer management

The most commonly used growth medium of spirulina cultivation is ZARROUK'S Medium. The preparation of Zarrouk's medium is required for following chemicals.

Table 1

S.No	Constituents	Amounts /litre.
1	Sodium bicarbonate (NaNO3)	18gms
2	Sodium nitrate (NaNO3)	2.5gms
3	Potassium phosphate di basic (K2HPO4)	0.5gms
4	Potassium sulphate (K2SO4)	1.0gms
5	Sodium chloride (NaCl)	1.0gms
6	Calcium chloride(CaCl2)	0.04gms
7	Ethylene diamine tetra aceticacid disodium salt (Na2-EDTA)	0.08gmd
8	Magnesium sulphate (MgSO4)	0.2gms
9	Ferrous sulphate (FeSO4)	0.01gms
10	A5 metal solution	1ml

. **Table 2**

S.No	A5 metal solution	Amounts/Litres
1	Boric acid (H3BO3)	2.86gms
2	Ammonium molybdate [(NH4)6MO]	0.02gms
3	Manganese chloride (MnCl2)	1.8gms
4	Copper sulphate (CuSO4)	0.08gms
5	Zinc sulphate (ZnSO4)	0.22gms

Growth factors

Agitation- it's done every 2-3hrs regularly in a day time.

Salinity- the healthy ranges between 15 to 20ppt.

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

Ph - the best ph ranges between 10.5 to 11. As below 10.5 pHs is a risk of contaminated with other microalgae and ph over 11it undergoes chemical changes.

Temperature - optimal temperature ranges from 30 to 35℃

Transparency - must be monitored every day. Because it is used to calculate algae density in tanks. The best ranges of transparency 20 to 25cm.

Harvest and yield

The first harvest should be started in 15 to 20 days, then regularly harvest by day today. Harvesting takes in morning 6 to 8 am suitable time for high yield. Because the sunlight reaches the culture tank, the algae started in reproduction for cell fusion, so reduce in cell size. Every harvest should be added growth medium regularly. Yield up to 15kg for wet weight and 1kg for dry weight.

Table 3 Nutritional composition

	Nutrients	**Amounts/grams**
1	Protein	55 to 70g
2	Lipid	4 to 5g
3	Carbohydrates	15 to 18g
4	Chlorophyll	1 to 2g
5	Mixed carotenoid	350 to 450mg
6	Beta carotenoid	180 to 190mg
7	Calcium	400 to 600mg
8	Iron	50 to 100mg
9	Potassium	200 to 2000mg
10	Magnesium	200 to 300mg
11	Zinc	1 to 2.0mg
12	Vit.A	100 to 200mg
13	Vit.E	5.0 to 20mg
14	Vit.B1	1.5 to 4.0mg
15	Vit.B2	3.0 to 5.0mg
16	Vit.B6	0.5 to 0.7mg
17	Vit.B12	0.05 to 0.2mg

Conclusion

WHO (world health organization) also suggest that adding the daily diet will naturally boost the immune system of your body. Spirulina is contributed animal feed as Mainly on ornamental fish farming for increasing the colour pattern of fish. So proper training and

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

technology to the cultivation of such nutritious algae can be lead to make a good profit and improve the unemployed and rural livelihood opportunities in the society.

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Volume 3 – Issue 2
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CONTRACT FARMING IN THE CONTEXT OF INDIAN AGRICULTURE

Article Id: AL202133

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The agrarian system of India has undergone major transformations in production, processing as well as the distribution process for maintaining the parity with the changing food habits and preferences of the consumers. However, fragmented "back end" activities (*i.e.* production aspects) have always been considered an important concern for the Indian agriculture sector (Gulati, 2008). The major challenge lies in connecting the link between farmers and agri-businessmen for enabling the profit generating opportunities at both the ends as well as enhancing the strength of the country's economy. The recent diversifications in agricultural production, as well as the marketing sector, has gradually led to establishing "farm-firm" linkages for increasing productivity, profit as well as the income level of the farmers. Contract farming is considered as one of the most important "farm-firm" linkages prevailing in India, having immense potential to boost the agribusiness sector of the county.

Contract farming can be defined as a system for production and supply of a particular commodity by the producers at a pre-agreed price, time, quality and quantity as per the advanced contract signed between the producer and the buyer. So, basically, contract farming provides a linkage between the farmer/producer and the agribusiness farm through an agreement regarding various predetermined conditions on production and marketing aspects of the commodity. However, contracts can be classified as production contract (firm manages all the input supply and the farmer becomes just a supplier of land and labour) and procurement contract (only sale and purchase conditions are specified).

History of Contract Farming in India

In the 1990s, contract farming in India has introduced by PepsiCo which set up a factory in Punjab in order to procure tomatoes from the farmers for their processing and value

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

addition. Tomato productivity had shown an increasing trend from 7 T/acre to 20 T/acre as a result of this intervention. It also adopted various scientific and modern technologies for reducing the cost of production as well as enabling the farmers to realize the higher profit. Currently, there are numerous private/public companies which are associated with contract farming of specified products like poultry (Coimbatore hatchery), Pulpwood (ITC), Mushrooms (NAFED) and so on.

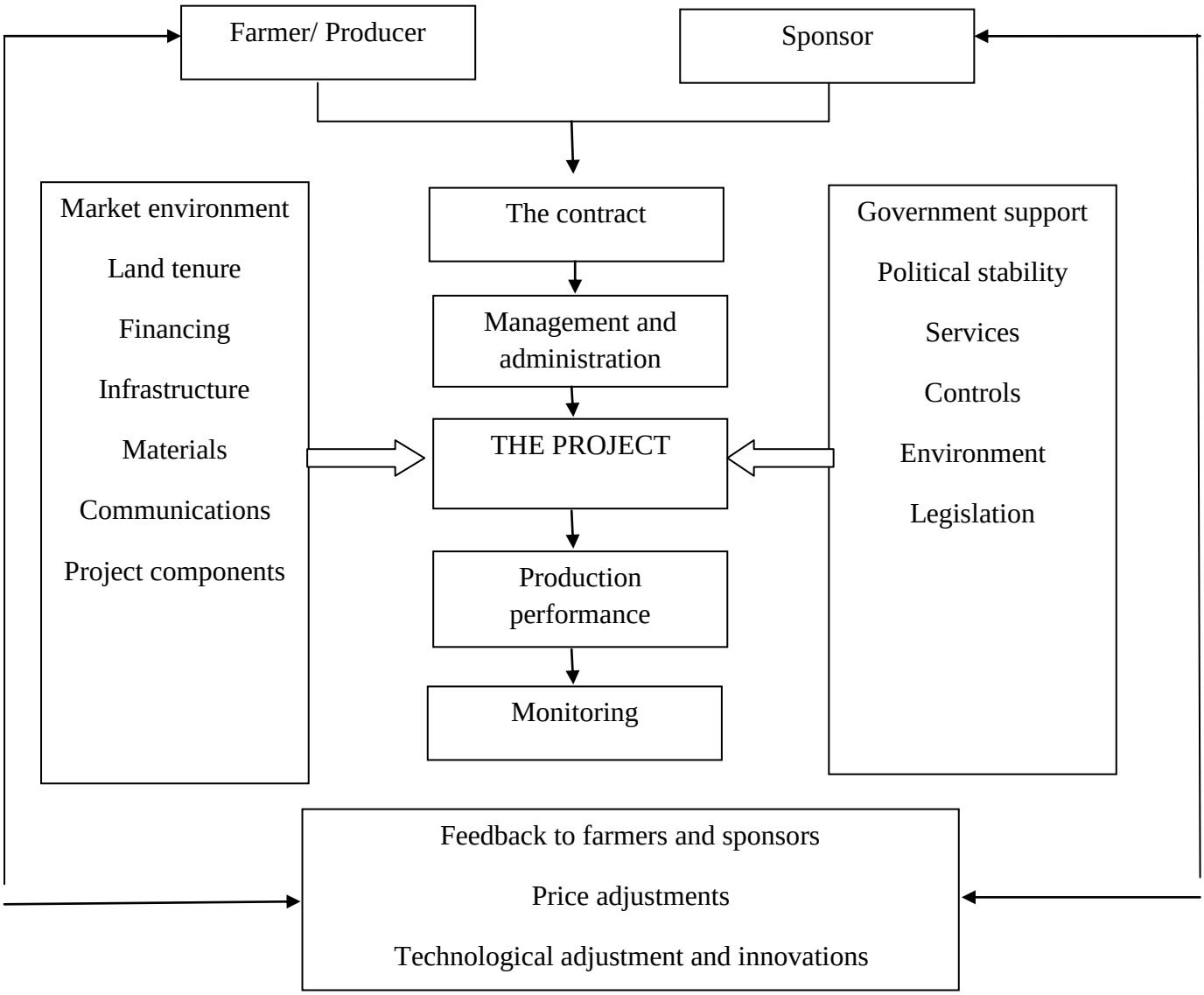

Fig.1: Framework of contract farming

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

Contract Farming Models

There are five types of model based on operations. Such is

a. Centralized model

It is the most classical contract farming model, which is characterized by a direct agreement between a single firm and a large number of producers.

Special features: The quantity is usually predetermined at the beginning of sowing season with strict enforcement of quality standards. The buyers' involvement may vary from minimal input provision (e.g., specific varieties) to control of most production aspects (e.g., from land preparation to harvesting). The coordination between farmers and the contractor is vertically organized. Products under this contract are sugarcane, cotton, vegetables, tea, coffee, *etc*.

b. Nucleus estate model

This is a modified version of the centralized model in which the buyer procures the produce directly from contracted farmers as well as maintains his own estates. This model is also called a "out-grower model".

Special features: This model ensures regular supply of crop with significant investment by the buyers in land, labour, machines and management. Important for research and demonstration purposes. It ensures cost-efficient utilization of installed processing capacities. Products under this contract: Perennials.

c. Multipartite model

This model includes multiple participants such as joint venture between governmental statutory bodies, public and private companies as well as financial institutions.

Special features: The agreement is complemented with several 3rd party service providers like consultancy, finance, extension, training and logistics. There is the provision of equity shares for the producers. Farm-firm linkages depend upon the discretion of the firm and often affected by political interferences.

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

d. Informal model

This is the most speculative one among all the contract farming models, with a high risk of default at both the ends. Trustful relationship, as well as honesty in case of both the parties, may have a chance to reduce the risk.

Special features: Small farmers make informal and seasonal agreements with small firms. There is less chance of advancement in technology in terms of processing, value addition and distribution. There is limited delivery of input, credit and information facilities. Products under this contract: fresh fruits/vegetables in daily markets.

e. Intermediary model

The buyer subcontracts an intermediary (collector, aggregator or farmer organization) who formally or informally contracts farmers (It is a combination of the centralized/ informal models).

Special features: The intermediary provides several incentives in the form of training and credit facilities to the buyer against service charges. This model can bear disadvantages for providing incentives to farmers (buyers may lose control of production processes, and there is also a risk of price distortion and reduced incomes for farmers).

Advantages and disadvantages related with contract farming

Contract farming is associated with significant pros and cons for both the parties, some of which are listed below.

Advantages:

a) For farmers-

1. Farmer is often supplied with the input and production services by the sponsor.
2. Contract farming helps the farmers to adapt advance technological skills.
3. Sponsor also provides credit and other institutional facilities to the farmer.
4. Farmers' price risk gets reduced as well as there is advancement in market opportunities.

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

b) For sponsors-

1. There is assurance in terms of quantity, quality as well as timely production of the commodity.
2. There will be an uninterrupted flow of raw materials for the processing plant so as to raise the profit level of the sponsor.
3. There will be a negligible chance of land and labour constraints as it is abundantly available at the producer's level.
4. Sponsor company can diversify the product base and encourage the farmers to produce a wide range of products.

Disadvantages:

a) For farmers-

1. Inefficient management as well as the adoption of unfamiliar crops or varieties, lead the farmer to face both production and market failure risk.
2. Sponsor companies may exploit the farmers by manipulating the quality standards of commodities
3. Due to low production, market failure as well as improper guidance, the farmers become indebted in the long run.

b) For sponsors-

1. A farmer may breach the contract to sell the produce in different markets for getting a higher price than the predetermined price.
2. The farmers may divert the inputs towards other crops as a result of which the expected level of production is not realized.
3. There may be various socio-cultural constraints which may restrict the farmer to attain a desirable production level.

Conclusion

Contract farming is a medium for providing linkage between producer and agribusiness firm. In India, where distress among farmer is a common practice, contract farming provides an opportunity to reduce the price risk faced by the farmer. The role of the farmer is to provide quality products, while the role of the sponsoring agency is to provide

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

support to farmers in terms of inputs and technical assistance. There exist, several models of contract farming, as discussed, and all are relevant to India based on the situations. Despite several disadvantages of contract farming, there is a wider scope for improvements and opportunities for the betterment of Indian farmers.

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Volume 3 – Issue 2
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MONEY MAKING AGRI-BUSINESS IDEAS IN INDIA: LOW INVESTMENT WITH HIGH PROFIT

Article Id: AL202134

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Agriculture is the science and art of cultivating plants and rearing livestock. The history of agriculture began thousands of years ago, and it was the key to human civilization development. Still, agriculture is one of the evergreen sectors. Nowadays, there are so many agri-business ideas which are amplifying the standard of socio-economic status of farm-businessman.

Agri-business is actually growing and rearing crops and livestock, their production and marketing. For rural and sub-rural areas of our country, agriculture and agri-business are one of the major sources of their existence. These sectors depend much on the climate for their nourishment, but with the development of new technology and sciences, there are so many chances to get back high return from low investment, if anyone runs the agri-business with passion.

There are some agri-business ideas which are suitable for Indian circumstance to get high profit by investing low price. Like-

1) Agriculture farm

The farming-suited empty land can be used for producing crops as demanded locally. The investment for producing crops is not so high, but maintaining good quality production fetches high profit.

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

2) Tree farming

By growing trees help to make money can be grown on a tree farm. As the trees take a considerable time for growing, the waiting period of the earning money of this business is quite long. But the plantation and maintenance cost of this farming is low. To get a high return, tree farming is a very good idea to start.

3) Organic fertilizer production

Organic fertilizer production is a very easy way to get high profit only by knowing the production process. So, it becomes a household business.

4) Dry flower business

It is also the best idea for making a high profit. If one has land for growing flowers, then one can grow, make them dry and sell the dry flowers to craft stores or hobbyist or other stores.

5) Mushroom farming

Mushrooms are a good cash crop; they are rather easy to grow. The business of growing mushrooms can fetch a big profit within a short period of time. Cultivation of mushroom requires small space and low investment too. Nowadays, there is a high demand for this fungus. So, mushroom farming is one of the best ideas to get a high return.

6) Organic greenhouse

Organic green-house business helps to get out-of-season crops by investing low price. As organic green-house farming produce food, excluding the use of synthetic chemicals, the demand for organic products has constantly been increasing. So, buying land for making organic green-house is a very good idea to get high profit.

7) Becomes a florist

Farming flowers and selling them in the market are a very profitable retail business. With some innovation and creativity, the demand for flower arrangement and bouquets are always high for gifting, crafting, at the wedding. One can do wonders easily in the business.

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

8) Tea plantation

Tea plantation is one of the best possible options for starting a profitable business. With the increasing demand for tea leaves, this business has huge potential. Tea plants require acidic soil, high altitude and heavy rainfall. So, if the demographic situation is suitable for tea plantation, then this is a good agriculture business in India with low investment.

9) Farming of medicinal herbs

Farming medicinal plant at the commercial level is one of the best profitable agri-business ideas. If one has good knowledge about the herb, has sufficient land and has a certain license from the local Government, then she/he can start the business.

10) Jatropha farming

Jatropha produces oilseed as a source of energy in the form of biodiesel. Jatropha meant for a wasteland or less productive land to grow. By doing some research and gaining some knowledge, one can easily start the most trending money making agriculture business, i.e. Jatropha farming.

11) Soil testing

Not only agriculturist but any passionate individual can also start soil testing business with consistent dedication. Soil testing business requires knowing the fertility level, nutrition level present in the soil etc. So establishing a soil testing laboratory with Government certification is one of the best small farm business idea.

12) Agro-blogging

Agro-blogging is the blogs related to agriculture and farming, i.e. how to improve the farming skill by using new technology etc. Any individual having good knowledge of writing and agriculture, they can try agro-blogging with zero to low investment.

13) Fodder farming business

Fodder is the food given to the domestic animals for feeding, not the food they graze by themselves. Barley, oats, alfalfa etc. are the plants use for fodder purpose to feed

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

domestic animals like cow, pig, goat, horse etc. So, it is always in great demand to get high profit.

14) Horticultural crop production

Any interested person can produce fruits, vegetables, spices, flowers in greenhouses and nurseries. But the selection of the crop and the production method is very important. So, little knowledge about the horticultural crops is necessary for this business purpose. Besides this, exporting collective crops like fruits, vegetables, flowers etc., is a very profitable business with low investment.

15) Spices processing

The demand for the organic spices is very high not only in the local market but also in international market too as the spices are a very important ingredient used in the kitchen regularly. Processing and packaging spices are not very difficult to work. So, anyone can initiate this business with low investment.

16) Fish farming and hatchery

Fish hatchery is a place where artificial breeding, hatching and rearing can be done for commercial purpose. With the implementation of modern technique, one can increase the production and quality of fishes as it is the most economical agro-based business idea.

17) Poultry farming

In the last few decades, poultry farming is the fastest growing industry. Domesticated birds like chicken, ducks, turkey, quails etc. are reared to produced meat and egg for human consumption purpose. Therefore it is a very demanding business to get high profit.

18) Bee-keeping business

The demand for honey is increasing day-by-day for maintaining good health. Apart from this, the wax is also a demanding product get from beekeeping. So, to fulfil the demand and to sell the products in the market, bee-keeping is a great idea with a small investment

19) Dairy farming

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

The demand curve for milk and its products will never go decline. Besides this, manure and meat are the other products we get from dairy farming. So, rearing of cow, goat, sheep, a camel in a hygienic way is nowadays is increasing for this farming. Hence, it is a good idea for initiating this as an agro-based business idea.

20) Oil production

Oil production from palm, sunflower, rice bran, soybean is a demanding business idea. It is profitable, as well as capital intensive. One can also focus on the export of oil to get high profit.

Conclusion

The aforementioned ideas will be helpful if anyone, before starting any agri-business, should conduct a research on the demand of the product, the production method, it's marketing, the land-use efficiency, animal and poultry nutrition, plant nutrition etc. and should understand the law and regulations and should register business licenses.

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Volume 3 – Issue 2
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www.agriallis.com

GREEN REVOLUTION OR THIRD AGRICULTURAL REVOLUTION: POSITIVE AND NEGATIVE IMPACTS ON AGRICULTURE

Article Id: AL202135

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The Green revolution is defined as the transfer of modern research technologies occurring between the year 1950 and late 1960s, which enhanced agricultural production markedly throughout the entire world, more specifically in the late 1960s. It emphasized the cultivation of high yielding varieties of particularly wheat and rice, to increase food production, especially in India. The new seed varieties or 'miracle' seeds of wheat were developed in Mexico and of rice in the Philippines, but the dwarf wheat varieties provided the bigger growth in yield per hectare. The 'Green Revolution' term was first used by William S. Gaud who was the administrator of the U.S. Agency for International Development or USAID in 1968, for introducing new technologies and policies implemented in the developing nations with assistance from the industrialized nations between the 1940s and 1960s to increase production and productivity of food crops (Conway, 1997 and Dalrymple, 1979). During this revolutionary period, the productivity of agriculture throughout the globe was accelerated gigantically due to application of new technical advances. Norman Borlaug was considered as the 'Father of the Green Revolution' and received Nobel Peace Prize in the year 1970 because he successfully helped in saving more than billion people from acute starvation through the implementation of basic approaches like the development of HYVs of cereals mainly, expansion of efficient irrigation infrastructures, administration of modern management methodologies, the wide distribution of hybrid seeds, use of synthetic or chemical fertilizers, herbicides as well as pesticides to the cultivators.

History and overview of the Green Revolution

Green Revolution refers to the renovation of farming methodologies which were started in Mexico in the 1940s. Due to its success stories in producing more agricultural commodities in Mexico, the technologies gad spread throughout the world in the 1950s and 1960s, remarkably improving the calories produced per acre of cultivated area. The Green

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

Revolution is more frequently attributed to Norman Borlaug, an American scientist who had received a Nobel Prize in the year 1970 for his pioneering work on the wheat crop with the objective was to enhance crop productivity by means of technical progress deprived of any type of meaningful economic or social reforms of the agrarian sector. Norman Borlaug developed new disease tolerant HYVs of wheat by conducting research in Mexico in the 1940s. Through the combination of these modern and improved wheat varieties along with the mechanization of agriculture, the country soon turned into a huge exporter of wheat by the year of 1960s because of higher wheat production than the requirement of its citizens. In order to use the newest technologies continue to produce more food for a growing population throughout the globe, the Rockefeller Foundation and the Ford Foundation, as well as many government agencies funded research possibilities. Afterwards, Mexico constituted an international research institution, namely 'The International Maize and Wheat Improvement Center' in 1963. Majority of the countries were benefited from the works carried out by Borlaug and CIMMYT. This revolution also helped India positively as our country was in the extremity of severe famine in the early 1960s due to the huge explosion in population pressure. Borlaug along with the Ford Foundation, implemented research in our country and developed a new variety of rice, namely IR 8, which produced more grain per plant cultivated with irrigation and synthetic fertilizers. In recent times, India is one of the world's leading rice producers, and the cultivation of IR 8 rice spread throughout Asia in the decades following the rice development in India. The research and development of new HYVs of wheat were carried out at Centro Internacional de Mejoramiento de Maiz y Trigo or the International Center for the Improvement of Maize and Wheat (CIMMYT) in Mexico, and the research of HYVs of rice was carried out at the International Rice Research Institute (IRRI) in the Philippines. Both these centres were members of the Consultative Group for International Agricultural Research (CGIAR), a network of 15 research centres across the world, each with its own major research responsibilities and priorities in the field of agricultural growth and development.

Effects/negative impacts/issues of Green Revolution

Although the Green Revolution had several benefits, it had a gloomy side too that affected both the environment and society. Some of the negative effects of the Green Revolution are stated below:

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

a) The excessive utilization or application of fertilizers, herbicides and pesticides adversely hampered the environmental equilibrium due to increased pollution.
b) The new toxic materials added to the soil and plants polluted the soil and water around the fields.
c) The soil pollution led to declined or impaired soil health and quality that accelerated the hazard of topsoil erosion by the action of wind or water.
d) Indiscriminate killing of useful insects, microorganisms and predators that naturally check excess crop damage by insect pests
e) Considerable loss of biodiversity occurred.
f) The cultivation of a small number of crop cultivars with an aim to produce higher yield levels declined genetic diversity among different species.
g) High yielding varieties can increase irrigation requirements thus placing stresses on India's water budget leading to lowering of the water table or creating water shortages or depleting the groundwater reserves
h) Increased salinization
i) Reduction in natural soil fertility; soil degradation or contamination; destruction of soil structure; impaired aeration and reduced water holding capacity of soil
j) Susceptibility of soil to water and wind erosion as well as silting of reservoirs
k) Greater vulnerability to pests and breeding of more virulent and resistant species of pests
l) Development of resistance to one species of pest due to **genetic modification** might invite other species of pests to attack the crop; for example, bollworm being replaced by other pest species in case of Bt cotton
m) Reduced availability of nutritious food crops for the local population
n) Diminishing return on inputs
o) Rural impoverishment
p) Displacement of small and marginal farmers and increased social conflict due to the focus on large farms and wealthy farmers who could acclimatize with the more resource-intensive agricultural methods introduced in the early period of the green revolution in India
q) Increased use of pesticides is leaving residuals in the environment
r) Retardation of agricultural growth due to inadequate irrigation coverage, shrinking farm size, failure to evolve modern technologies, inadequate use of technology, declining plan outlay, unbalanced use of inputs, and weaknesses in credit delivery system

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

s) The benefits of the green revolution remained concentrated in the areas only where the new technology was used.

t) Its benefits were mostly accrued only to wheat-growing regions.

u) Increased rural inequalities and evolution of regional inequalities due to regional dispersal in terms of socio-economic disparities and landholding concentration

v) Interpersonal inequalities between large and small scale farmers were observed as the new technologies demanded substantial investments which were beyond the capability of a majority of small farmers but farmers having large farmlands continued to make greater absolute benefits in terms of monetary income through reinvestment of their earnings in the fields of farm and non-farm assets, purchasing land from small peasants, etc.

w) Endangering the health of the farmers and workers who produce them; poisoning the food with highly toxic pesticide residues; chemical changing the natural taste of the food and increasing the farmers' work burden and tension

x) Increased agricultural expenses due to high inputs costs, depletion of the fossil fuel resources, increased irrigation needs of the land for cultivation of HYVs

y) Lowering of the drought tolerance of crops and the appearance of problematic weeds

Advantages or benefits of the Green Revolution

The benefits of Green Revolution are described below:

a) Firstly, larger quantities of food could be produced due to the introduction of chemical fertilizers, synthetic herbicides and pesticides, HYVs as well as hybrids, and multiple cropping.

b) Productivity enhancement was very much successful in feeding the burgeoning population.

c) A strain of short stature wheat was developed in Mexico by Norman Borlaug in 1940s which imparted tolerance against pests and diseases, the abrasive action of wind and would produce larger seed heads and higher productivity.

d) Within a span of only twenty years, wheat production was tripled.

e) Mexico became self-sufficient and started to export their wheat and sell it in other countries.

f) Norman Borlaug developed the HYVs of rice and wheat particularly and won a Nobel Peace Prize for preventing hunger, malnutrition or starvation in many developing countries.

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

g) On the other hand, it became possible to grow more crops on roughly the same amount of land with a similar amount of effort resulting in reduced production costs and cheaper prices for food in the market.
h) The capability of achieving higher production level on a similar amount of land was advantageous to the environment because less forest or natural land was needed to be converted to farmland to produce more food.
i) The natural land that is currently not needed for agricultural land is safe for animals and plants for their natural habitat.

Characteristics features of the Green Revolution

Followings are treated as a 'package of practices' to supersede 'traditional' technology and to be adopted as a whole.

a) Adoption of new technologies
b) Cultivation of high yielding varieties (HYVs) of cereal crops, especially dwarf rice and wheat
c) Excessive utilization of chemical fertilizers, synthetic herbicides, pesticides and other agrochemicals
d) Chemical fertilizers made it possible to supply crops with extra nutrients thereby increasing yield level
e) The synthetic herbicides and pesticides managed harmful weeds, deterred or killed insect pests and prevented diseases ultimately leading to higher productivity
f) Controlled water supply usually involving improved irrigation systems
g) Promotion of agricultural mechanization
h) Implementation of multiple cropping
i) Double cropping in the existing farmland
j) The continuing expansion of farming areas
k) Commercial crops and cash crops such as cotton, jute, oilseeds, etc. were not a part of the plan
l) The first wave of Green revolution in India mainly emphasized food grains such as wheat and rice which helped the country to attain self-sufficiency level in production by the year 1970 and it was mainly restricted to the HYVs of wheat in certain north Indian states like Punjab.

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

m) The second wave in our country emerged with significant agricultural growth in 1980, which included not only different regions across India beyond northern states but also involved many other crops, including rice and wheat.

n) It possessed the capacity to enhance income sources remarkably in some regions in rural India, though many other areas remained considerably poor.

Green Revolution in Indian context

Green revolution in the Indian context is referred to a period when agriculture was transformed or converted into an industrial system owing to the wide adoption of modern methods and technologies such as high yielding varieties, tractors and other machineries, irrigation facilities, pesticides, and fertilizers. The concept was mainly found by M. S. Swaminathan, 'Father of the Green revolution in India' and this initiative was an important part of the Green revolution carried out by Norman Borlaug, through research and technologies to enhance agricultural productivity in the developing countries. Under the leadership of Lal Bahadur Shastri, Green Revolution in our country was commenced in the year 1965 with the development of high yielding and rust disease tolerant varieties of wheat that ultimately led to enhanced food grain production especially in Punjab, Haryana, as well as Uttar Pradesh. Nevertheless, this revolution was proved to be a useful measure and was a pioneer in helping the government to independently produce essential crops in India without relying on foreign exports.

Conclusion

Green revolution protected our nation in another way whose policies were often misused by the foreign nations for blackmailing our country with the aim of serving their own political purposes and are dominated by those nations. The successful progress of these revolutionary changes transformed the status of the country from a food deficient economy to one of the world's leading agricultural nations which started in 1967 and lasted till 1978. India reached its road to self-sufficiency in terms of production to fulfil the requirements of escalating population pressure, stock for emergencies and was less dependent on imports from foreign countries; besides started export of different agricultural produces. The anxiety among people inhabiting in India about commercial farming that it would certainly result in severe unemployment and leave a majority of labour force jobless was prohibited by Green Revolution; instead, the outcome was completely different, and it was observed that there

Volume 3 – Issue 2
Online ISSN: 2582-368X
www.agriallis.com

was an enhancement in rural employment opportunities due to the tertiary industries such as transportation, irrigation, food processing, marketing, etc. Farmers were highly benefitted as they not only survived but also prospered during the revolution period, and their income saw a significant rise which enabled them to shift from sustenance or subsistence farming to commercial farming.

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WEED MANAGEMENT -A PARADIGM SHIFT

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Weeds are a major concern in agricultural production as these cause up to one-third of total losses in yield, reduce produce quality and impose various hazards, to both health and environment. Among all the pests, weeds cause about 33% loss in crop production. Besides crop losses, they also harm the non-crop situations, aquatic bodies and interfere with human activity. Weed management is a multi-disciplinary task. Understanding the weed biology, ecology and developing environment friendly control technologies are key to modern crop production. Weed management under different cropping system or crops is an important ingredient of crop cultivation, which desires to develop by moving away from its single disciplinary approach to multidisciplinary methodology for weed control. Sometime verreliance on few single herbicide such as Isoproturon etc leads to develop herbicide resistant problem to few specific weed species. Various weedicide become and effective tools for various weed control measures, however due to change in weed phenotype or genetic characters leads to evolve herbicide resistant problem now. This can be sorted out based on ecological principles and nonconventional weed control options. The “many little hammers” concept and the “use of technological advancement” are two vital comprehensive weed suppression mechanism that are gaining impetus. Weed management under vegetable crops and organic cultivation, through automated robotic system becoming gaining important day by day in developed country. Further, use of cover crop, crop rotation and weed seed destruction technique are becoming popular in farming community. In future, RNAi expertise, robotics and gene editing will capitulate new technique for weed management. Proper crop management under various integrated farming system is moving into a new era of big data or “digital farming. This approaches will be very effective and become challenging to weed control under new era of crop cultivation, which will allow more intellectual use and modern tools and technique for precise weed management under diverse crop ecosystem.

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One of the major challenge that is being confronted by food growers in the 21st century is producing sufficient foodstuff to match the mounting requirements of our burgeoning population, while safeguarding the agro-ecosystem and protecting the rural community and socioeconomic well-being of food producers (Nave *et al.*, 2010). One of the major challenge is effective and timely weed management under different cropping sequence/system. Weeds can compete with crop ecosystem for light, water and nutrients, which leads to noteworthy plant loss and decline in yields in every year (Mukherjee, 2018). For decades, worldwide, food growers heavily depend on use of various herbicide for effective weed management. This become quite effective option after the Second World War (Gianessi, 2013). Herbicides replace a series of more difficult weed control methods, such as manual weeding, ensuing in lower labour and time inputs for the farmer's, abridged energy or fuel expenses as well as augmented yield potential. Heavy dose of herbicide imbalance our ecosystem and affect livelihood of common people.

Worry of weeds and control measures

Weed interference in crop ecosystem is challenging to the growers because it reduce crop yield and also mixed with grain, which reduce market value of crop in international marker. Approximately 37 to 61 % yield reduction observed in cereals and pulse due to weed problem. Use of various weedicide is the main weed control strategy under present context. Dependence on this limited number of herbicide or mono cropping pattern vehemently has led to the development of herbicide-resistant weeds. While many farmers are incorporate unlike herbicides, this is likely to have only temporary success. As a consequence, herbicides or chemical weed control are in need of additional support to continue to ensure proper weed control. Integrated Weed Management (IWM) strategy is multiple weed control tactics help to control wide range of weed population in an effective way. Using non-herbicide approaches under different organic crop cultivation with numerous, effective sites of action is needed for long-term success under different weed control programme. Various IWM plans can be integrated without considerable change to present management programs, while others require more wide planning and execution. Few measures that we can adopt under different weed management programme are altering herbicide tank mixes, equipment cleaning etc. while more broad option comprise of cover cropping, changing crop rotation, altering tillage options, and harvest time mixing of weed seed to the economic produce.

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Fig. 1: Manual weeding in crop field- labour intensive processs

Fig.2: Study on weed population in crop field

Herbicide resistance in weeds

It's an established fact that certain prominent weeds have got resistance to one or more herbicides. has been found to have resistance to isoproturon. It is also reported that it is getting resistance to sulfosulfuron or even clodinafop in few cases in Haryana. If in the cropping season you happen to visit different wheat growing areas in West Bengal, UP, Haryana etc., you will find that almost all fields are infested with vigorously though the crop has been treated with existing herbicides. One may say that this situation might be due to use of spurious herbicides but in research experiments the resistance has also been observed in Hissar and Jabalpur, etc. Glyphosate, a prominent herbicide, does not control many weeds as per records available. Genetically modified herbicide resistant crops may lead to development of super weeds which may create a challenge if the cultivation of such crops comes into existence. Therefore, it would be a great challenge to develop molecules which can break the resistance. Under intensive crop cultivation practice our emphasis mainly confined to high input systems, such as more irrigation, fertilizer etc which create more weed problem in crop field. Awareness of unfavourable effects of various chemical residues on human and animal health, ecosystem damage, development of herbicide-resistant weed biotypes, a noteworthy focus within weed science has now shift to the development of eco-friendly technology with

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less dependence on herbicides (Fig.3). Further, under changing climate pattern weed shifting become a multi-faceted challenge for weed scientist.

Fig. 3: Awarness campaign against herbicide resistant problem

Table 1. Herbicide resistance in different weed species

Herbicide	Weed species	Crop	Country
Trifluralin	*Eleusine indica* *Setaria viridis*	Cotton Cotton	USA Canada
Chlorsulfuron	Five species	Wheat	USA
Paraquat	*Conyza sp.* *Epilobium ciliatum* *Poa annua* *Lolium perenne*	-	—— Australia USA
2,4-D	*Sinapsis sp.* *Ranunculus acris*	Wheat	New Zealand
MCPA	*Cardus nutans*		
Cholrotoluron	*Alopecurus myosuroides*	Wheat	England
Diclofop-methyl	*Lolium rigidum*	Wheat	Australia
Isoproturon	*Phalaris minor*	Wheat	India

Weed management under present crop scenario become very tough and it should be done with proper knowledge of field and seed bank nature in the surrounding area. Few control practices are discussed here as per recent research and experience.

Volume 3 – Issue 2
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1. Prevention of entry: Entry of any weed seed either from crop field or from outside source should be avoid. This mainly includes keeping weeds out of the field or spreading within a field.

2. Cultural practice : Proper and good management of crop is one of the important aspect of cultural measures. practice. Adoption of various cultural measures help farmers to more cut-throat against any unwanted plant or weeds (Mukherjee, 2020). This mainly includes, maintain best field nutrient accessibility, reducing row spacing and selecting suitable cultivars under weed-free environment.

Fig. 4: Weed management vs. weedy field under Field Level Demonstration programme.

Fig. 5: Improved weed management result in farmer's field (FLDs)

Volume 3 – Issue 2
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3. Herbicide efficacy : Herbicides use pattern is one of the most vital factor under present context, as this is labour saving and timely management is possible. Herbicide efficiancy can be increase by timely scouting, proper dose of herbicide application, weed identification and awareness of what herbicide-resistant weeds are in the area etc. Some time efficiency of herbicide increase with the tank mix use of different herbicide which have synergistic effect on crop health. Observation on field level data revealed that, proper and timely management of weed increase wheat yield 33 to 56 % under different FLDs. programme in wheat. Proper and timely weed management at critical crop growth phase become a very challenging and crucial task for our farming community.

4. Mechanical approach : This mainly include various physical approch with advance tools and technique mainly by disrupt germination and destroy plant tissue (Mukherjee, 2019). This can be possible with the tillage, hand-pulling, burning of crop residue, mowing, robotic weeding machines etc.

4. Natural control : This mainly include biological measures, which includes uses of living organisms to against different weeds and other microbe effect. One major drawback in this approach is location specific. Many of biological strain become ineffective under varied situation.

To overcome various technical challenges, recent decades have witnessed significant progress in the form of site-specific weed management systems, herbicide-resistant transgenic crops, drones to monitor weed population dynamics, omics, novel herbicides, molecular biology tools, nanoherbicides, and simulation and decision support modeling. The human dimension is somewhat more difficult, and weed management has to grapple with issues such as farmers' failure to appreciate the extent of weed menace, especially where the damage and losses are not apparent. Assessment of the environmental impact of weed management practices has formed a new and a relevant area of research in weed science. Against the backdrop of precision agriculture, advancements in the field of engineering and computer sciences can help quickly identify and control weeds with precise recognition and application modules. For weed science to thrive and respond to future weed problems, greater global collaboration will be required between this discipline and biological science, computer science, engineering, economics, and sociology. Combating with various weed flora challenges, recently site-specific weed management systems along with precision agriculture

Volume 3 – Issue 2
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practice become getting paramount importance. Further, our advance research programme should be focus on drones to monitor weed population dynamics study technology, herbicide-resistant transgenic plants, nano-herbicides, omics, new herbicides formulation, molecular biology tools, and simulation and decision support modeling. Channelizing and harnessing interdisciplinary teamwork and education of farmer's, coupled with information exchange, could help solve multifaceted challenge with more varied and flexible approach, and accomplish greater harmony – so avoid doubts and critique.

Conclusion

Weed problem is becoming a very challenging field, not only for scientist but also for farming community too. Weed control aspect, change manifold during last decade, however sometime unsafe to our ecosystem and farming community. Proper and timely weed management play significant role for higher productivity of crop per unit area and benefit:cost ratio. .

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