



Pros & Cons of Farming Systems-Practices in Agriculture: A Discussion

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Abstract

From the time immemorial agricultural activity is in practice around the world mainly under rainfed-shifting cultivation. With the advancements in knowledge introduced irrigated-permanent cultivation agriculture. With the unabated population growth food needs increased multi-fold. Since 1960s seeds have been developed tailored to chemical fertilizers to monopolise seed-chemical fertilizers industries. Under these scenarios entered private agencies in agriculture. These varied with developed and developing countries. With this several types of farming systems practices have entered into agriculture. Few broad such farming systems are traditional, commercial, corporate, contract & cooperative. Traditional farming is individual family farming. In others family is replaced by firms or groups of families covering large acreages. Traditional farming has three phases, namely ancient/primitive, conventional and modern. These are associated with the time, social conditions, rainfed/irrigation conditions, crop and animal conditions, fertilizer & seed conditions, etc. Conventional farming has several connotations like organic farming, natural farming, etc. based on nature of “natural fertilizers’ use” with the same ingredients such as farmyard manure. Farmers coming together under “farmers’ cooperative system” and follows the traditional farming practices. The farmers under contract produce what the contract firm wanted as per the agreement. Contract farming is practiced with tobacco cultivation in India. In the case of corporate farming, corporate firms execute the farming. Corporate firms’ takes the farmers land on lease. However, those farmers work as labourers in their own land. This has the disastrous impact on environment. In this another form is in practice, namely tenant farmers. In developed countries where fewer members are in farming have been basically following commercial or contract farming carried out initially with labour brought from outside and later through mechanization with huge governmental subsidies. This is nothing but modern [traditional] farming but involves large area. It changed in to corporate and contract farming, particularly in developing countries. In all those systems of farming pollution is the hall-mark where chemical inputs form part [air, water, soil & food]; and thus entered drug manufacturing industries and health care institutions those in term started generating new types of pollution and thus the vicious circle is moving on. Use of heavy machinery destroyed the soil structure in crop root zone and thus reduced the water retention capacity in the top crop root zones.

Keywords: farming; traditional farming; commercial farming; corporate farming; contract farming; cooperative farming

1. Introduction:

With non-linearly increasing population, weather aberrations, rapidly changing technologies, increased area under irrigation, etc. the systems of farming have been changing with the passing of time and all these introduced the hazardous air, water & soil pollution; and thus food pollution, which are causing innumerable health hazards (Reddy, 1993, 2000, 2003). To cure those hazards rapidly expanding drug manufacturing industries and health care facilities that are adding more pollution – This is known as a vicious circle. Stan Cox brought out a book in 2006 title “Sick Planet: Corporate Food & Healthcare”. Reddy (2021a) presented on pros & cons of three Agri Bills brought out by the Indian government, in which contract farming formed the main component. However, later the government withdrew these three Agri Bills. Reddy (2021b,c,d & 2022a,b) presented few issues.



In India the rainfed agriculture is in 75.7 mha & net irrigated area is in 65.3 mha; 82.6% of farmers hold less than 2 ha [< 5 acres] primarily grown millets & pulses. Similar trends are seen other developing countries too. Under this scenario discussed the broad Farming Systems prevailing around the world in brief. However, we must not forget the basic issue: some are working to produce to meet their basic needs and local needs; and some others for commercial needs [exports, local corporates]. While classifying, sometimes they are misclassified. The Indian farming market was worth INR 18,367 Billion in 2019. The farming sector constitutes one of the most important areas of the Indian economy. India currently represents the world's largest producers of many fresh fruits and vegetables, major spices, selected fibrous crops such as jute, several staples such as millets, and castor oil seed. India is also the second-largest producer of wheat and rice, the world's major food staples. Currently, India ranks within the world's five largest producers of over 80% of agricultural items, including many cash crops such as coffee and cotton. Crop yields in India have also increased significantly over the last several decades. Factors such as farm mechanization, increasing usage of fertilizers, improving irrigation techniques, better seeds and easy availability of credit can regard as the major drivers of the Indian farming industry.

Cotton is a plantation crop and is the raw material for the cotton textile industry. It thrives on black and alluvial soil with low rainfall, bright sunshine and no snow. It is heavily produced in the US, Pakistan, Egypt, China, and India. Wheat is a staple food in the world, and it grows in moderate temperature regions. It requires good rainfall during planting and adequate sunshine when harvesting. It, therefore, grows well in northern India during the winter seasons; Rice is a staple food all over the world. It requires high heat, humidity, and rainfall. It thrives in West Bengal and other North-Eastern parts of India. The world's leading producer of rice are China & India. Other top producers are Bangladesh, Japan, and Sri Lanka; Maize, like wheat, requires moderate rainfall and adequate sunshine. It, therefore, grows well in the United States, Mexico, Brazil, India, Canada and Russia; Coffee thrives in a warm and wet climate on well-drained soil. It is, therefore, grown massively in Brazil, Columbia and India; Tea is an important beverage all over the world. It grows best in a sloping landscape where there is adequate rainfall all year long, and temperatures are cool and not high. It grows well in China, Kenya, India and Sri Lanka; Beef and milk come from cattle, meaning cattle have to be reared in high numbers. Dairy cattle breeds such as Friesian, Jersey and Ayrshire are the best producers of milk. India is the world's largest producer of milk at 22%, with other countries such as the US, China, Pakistan and Brazil, also being top producers. The United States produces about 20% of the world's beef, followed by Brazil and the European Union at 15% and 13% respectively.

In India crops such as paddy, wheat, cotton, sugarcane, groundnuts, millets, etc. are grown large contiguous areas covering several farmers. These don't come under commercial farming but comes under conventional & modern [traditional] farming. The farmers individually sell to government agencies at minimum support price fixed by the government, time-to-time. Also, farmers use government subsidized inputs. In several developing countries state farms produce crops such as maize over large areas. India is a prime example of tobacco farming and

is the world's second-largest producer of tobacco. Though it is referred under commercial farming but in reality, it comes under contact farming. Individual farmers make an agreement with the buyer firm in advance. The firm clearly stipulates "crop rotation"; that is if a farmer grows tobacco on a piece of land this year, in the next year some other crop must be grown on that land; if not the buyer won't buy that tobacco.

2. Basic Concepts of Farming Systems:

2.1. Traditional Farming:

The traditional farming has changed its character with the time. We can see three such broad phases, namely Ancient/Primitive Farming, conventional Farming and Modern Farming. It is promoting genetic diversity and creating environmental awareness, creating awareness on modern and scientific understanding of ecology, soil science, irrigation, and on traditional methods such as crop rotations, compost/dung fertilizer, natural weed and biological-pests control, to protect the ecosystem. Domestication of animal and animal husbandry was linked with agriculture, a major boon to farming community in terms of economic & nutrient diet security. To meet the local conditions changes took place differently over different parts of the globe. In formulating all these soils and climate has been playing important role.

2.1.1 . Ancient/Primitive Farming:

Ancient/Primitive farming is the ancient food production system and it is the original type of agriculture was practiced for thousands of years. This is not only the world's oldest farming method but also the main source of improving phase of farming technology. This is also known as subsistence farming. Domesticating animals started. Extensive use of local or indigenous knowledge, spiritual, and superstitious beliefs in making agricultural decisions; Heavy use of primitive or low-tech tools such as the axe, hoe, and stick; Utilizing methods such as Slash & Burn and Shifting Cultivation – here the major player is natural variability in rainfall; Absence of accountability or responsibility to the environment; Lacks surplus productions - only just enough is made for the farmer and their family. The impact on environment includes depletion of soil nutrients, deforestation & soil erosion, practices like slash & burn decrease soil organic matter. These led to rapid depletion of nutrients and fertility in the soil, meaning after a while yields start declining, and farmers move to another plot of land to start again. The most concentrated deforestation occurs in tropical rainforests, and most of it is to make way for agricultural activities, as these require a lot of land and space. The removal of topsoil by water, wind, or tillage leads to plant roots being unable to hold firmly onto the soil. The topsoil is also the most fertile part of the soil, and once eroded can take decades to replenish. This is environment friendly agriculture. No pollution.

2.1.2 Conventional Farming:

All over the world the conventional farming is still in practice. This is the weather driven system. This is a successful system of farming under vagaries of monsoons. Here farming is linked with animal husbandry, which used to provide bullocks to till the land, provide fertilizer [farmyard manure] & part of food [milk &



mutton]. Here crops and cropping patterns adapted to rainfall patterns in a given location & soil type; that provides the feed to animals and improve the soil fertility conditions. Also, in the beginning of this phase among them was exchange of produce [for example grains for sweet potato; grains for services rendered in the agriculture, etc.]. In the conventional farming the system of farming has been improved to overcome the negative characters of the ancient or primitive traditional farming. Thus, the conventional agriculture can be defined as a primitive style of food production and farming that involves the intensive use of indigenous knowledge, land use, traditional tools, natural resources, organic fertilizer and cultural beliefs of the farmers. This is still the dominant agricultural food or production practice used by half of the world's population today. It is an efficient and sustainable farming. Modern organic farming is similar to conventional farming where farmer has a mixed farm of livestock, fruits & crops. In the conventional farming fertilizer is natural compost fermented for longer periods; while in organic farming it is created artificially in short period of time with similar ingredients – farmyard manure. In the conventional system the ZBNF's concept of Subhash Palekar of Vidarbha and others is basically a part in the farmyard animal-based compost. Traditional agriculture can boast one thing that the other techniques cannot - it has stood the test of time.

Conventional agricultural techniques are most often practiced on small family farms and in developing countries. Crops are mixed, often using multiple varieties of the same crop, and are sometimes planted in associated groups. For example, vine-based beans might be planted with corn. Crop timing is based on traditional experience and tilling, and other farm techniques are based on proven traditions. Modern techniques are often blended with conventional techniques. Because this sort of agriculture is based on artisanal knowledge, it does not scale up well and does not provide the enormous crop yields of industrial agriculture. However, it is often more sustainable and less polluting than similar industrial techniques. Popular conventional farming methods include agroforestry, crop rotation, intercropping, poly culture, water harvesting, & achieving food security. Agroforestry is one of the oldest farming methods. Agroforestry involves the deliberate planting and maintaining of trees on the same plot of land as agricultural crops. This leads to the development of a unique microclimate, while also protecting the crops below. Agroforestry is successful at controlling variables such as temperature, and exposure of sunlight, wind and rain. With the agroforestry, food, timber, firewood, and staple food crops are able to all be grown and harvested on the same land. Additional benefits include extra income for farmers, improving the soil structure and quality, reducing soil erosion, and more. In addition to the environmental benefits, agroforestry also carries strong social and economic benefits to local communities where it is carried out - for example in parts of Europe, the USA, and African countries. Crop rotation is the practice of growing different crops on the same land based on the season. It helps preserve the soil productivity, reduce pests, minimize use of chemicals, maximize yields, and reduce reliance on one set of nutrients.

The goal of crop rotation is to ensure positive interrelationships between cycling crops that will work together to build up soil health and fertility, and control soil erosion due to persistent root systems in the ground. Sowing more than two crops at the same

time is also known as intercropping, or mixed cropping. Usually, intercropping is a great way of maximizing use of resources and increasing yields and diversity of harvest on a single plot of land. There are several different types of intercropping. It is important to note that intercropping is different compared to crop rotation. In crop rotation, different crops are grown at different times, like a relay race handing over the growth baton to each other. However, in intercropping, the whole ranges of crops are all planted together at the same time. Intercropping creates biodiversity, which in turn improves pest management. It also helps in fumigating the soil by increasing soil organic matter and restrain weed growth. Hence Intercropping is a local approach that is based on traditional practices which is popular even today. This system provides good feed to animal also. Growing legumes and pulses provide natural nitrogen fixation.

Poly culture is a system to grow many plants of different species in the same area. It increases plant biodiversity and promotes a diverse diet among local communities. The various types of poly culture are cover cropping, permaculture and integrated aquaculture. The main advantage of poly culture is its ability to control weeds, pests and diseases without the use of chemicals. The opposite of monoculture is poly culture. It helps in reducing soil erosion and increases stable yields. It improves the quality of soil. Hence poly culture being the traditional method is still popular today across the world as it provides health and environmental benefits. Here farm bunds that help rainwater recharging, reducing soil erosion, trees planting on bunds, etc. With the passing of time ground water and surface water-based irrigation systems have been introduced. In this system animal husbandry and fruit crops are the major parts.

2.1.3 Modern Farming:

The phase of modern system entered after 1960s. This is chemical fertilizers tailored seeds technology. This created monopolization of seed and chemical fertilizers by multinational companies that increased the cost of production with the decreased quality of production. With this entered modern machinery that affected soil & water retention capacity in the root zone and contributed further increase in cost of production. This is a mono crop system. This affected the animal husbandry. Though traditionally good grain from his field or neighbours field grains used as seeds. Under modern farming initially government used to provide seeds at a cost but with GM seeds MNCs monopolized the seed and farmers have to pay several times to that of government and locally developed seeds from seed companies. Inputs costs have gone up by several times to Conventional Farming. Government introduced subsidies. Farmers' suicides and health hazards have been the major casualty; it survived with governments subsidies only. Without this no farmer ventures into this system of farming.

Large groups of farmers with irrigated agriculture shifted to modern farming system as after 1960s wherein started using modern technologies, chemical inputs – they call this as green revolution technology but I call it blue-green revolution as it created pollution unlike the conventional farming (Reddy, 2011 & 2019a). After 2000, it added another dimension in terms of genetically modified seeds. Genetically Modified Technology introduced by multinational seed giants where the life of seed appears to be very short and as time progresses introducing new



insect-pests-diseases those in fact affect the neighbouring farmers' fields unknowingly. Within 10 years Bt-Cotton seed was changed by three times and yet they fail to control new pests' diseases. To overcome this, UN banned [internationally] GB-II & GB-III seeds have been illegally brought into India. Thus, the costs of seeds have gone up (Reddy, 2000 & 2019a). With the modern gadgets the objective is to increase the quantity at the cost of quality. This destroyed the link between agriculture and animal husbandry-horticulture that used to provide economic and diet security. This also caused lots of damage on environment and human health.

Animal based fertilizer has been replaced by chemical-based fertilizers; Seed hither to this was the good grains from the farmers or his neighbour's farm. This was replaced by developed seeds tailored to chemical inputs. Here farmers must purchase seeds from the seed companies. GM seed was introduced at huge cost. This system affected the quality of whole spectrum of foods [agriculture, horticulture & Fish/Prawns cultures]; This has been introducing pollution in to the atmosphere [air, water, soil & food] and thus causing new spectrum of serious health hazards; To attend these new spectrum come up hospitals & drugs manufacturing industries; These in turn have been introducing new pollution in to the atmosphere and thus have been introducing new health hazards – a vicious circle. Cultivation is to be animal driven with locally manufactured equipment, but this has been replaced by machines manufactured by industry. The modern gadgets have been changing the stability of soils in the root zone and thus aggravating the drought conditions. In these systems the main beneficiaries are seed, fertilizer, cultivation equipment manufacturers, drug manufacturers, health care institutions, etc. They have been building empires and minting trillions of dollars each year and at the end the losers are hardworking farmers and people who consume that type of food. For inventing such hazardous gadgets, they were bestowed with Nobel Prizes. More than 50% of food produced is presently going as waste and thus to that extent inputs used to produce that is also going as waste. We rarely take this into account.

2.1.4 Sample examples of changes in cultivation mechanisms:

Figure 1 presents the bullocks drawn cultivation [it covers topsoil] – even agriculture produce is carried from field to home using bullocks drawn cart --; and Figure 2 presents milking of cow – now developed mechanised way of milking --. Figure 3 presents modern machine – tractor drawn cultivation [it goes into deeper layers of soil] – they are also used similar to bullock cart. Now drones entered in spaying and crops surveillances.



Figure 1: Traditional way of cultivation with Bullocks'



Figure 2: Traditional way of milking a cow



Figure 3: Modern way of cultivating with Tractor



Around the world there are several types of systems in use for drawing water from wells. The traditional one is using bullocks and the modern one is motor based pumping. For example it is either leather bag or chain of buckets is mounted on a drum. The endless chain is suspended in the well in such a way that the chain dips in the water to sufficient extent. The drum is connected by means of a horizontal axle to a toothed wheel which is also held in a vertical plane as shown in Figure 4a. This vertical wheel is geared with a horizontal wheel.

The vertical axle of the horizontal wheel is connected to a horizontal shaft. A pair of bullocks or buffaloes or a camel is yoked to the shaft by means of ropes and a yoke. The horizontal shaft is rotated with the help of animal power about the vertical axle. When the animal moves round the vertical axle of the system rotates. As a result bucket chain also moves. The buckets filled with water move up and when they turn down at the top of the drum the water is discharged. This water is collected in a trough from where it goes to the water course. The empty buckets then move onwards and go down in the well finally dip in the water of the well in inverted position and when they emerge out they are upright and completely filled with water. Thus the buckets when ascend are full of water and when descend they are empty. In this method water is lifted continuously as long as system is kept in rotation. This Method is very efficient. This arrangement of lifting water is suitable for lined wells and it can be conveniently used for deep wells up to a maximum depth of 30 m.

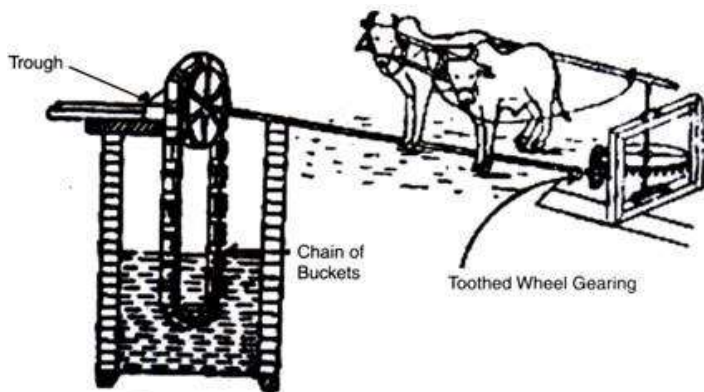


Fig. 17.11. Persian wheel

Figure 4a: Traditional way of getting water from wells -- Persian wheel

The other system consists of a leather container whose shape is like a funnel. There is a spout on one side and shape of upper portion is that of a conical cylinder. It is open at both ends. The capacity of the leather container or mote is from 0.08 to 0.15 cubic metres. Two ropes are tied to two ends of the mote as shown in Figure 4b. The ropes pass over two pulleys. Upper pulley is a circular fixed pulley of bigger diameter whereas a lower pulley for the rope tied to the spout end is cylindrical in shape and is of smaller diameter. The pulleys are fixed in the wooden framework as shown in the figure. Other ends of the ropes are connected to a specially prepared yoke. A pair of bullocks is employed to haul the mote. The bullocks move forward and backward on a sloping bullock run or a ramp. When the bullocks reach other (lower) end of the ramp the spout rests on the lower pulley and the conical portion remains above the lower pulley in suspension from the

upper pulley. Thus the water discharges through the spout. The discharging water may be collected temporarily in a trough constructed in front of the cylindrical pulley from where water is taken to the water course.

When the pair of bullocks comes back to the well end of the ramp the mote goes down in to the well and dips in water and gets filled. When the pair moves forward because of the tension the spout end comes in level with the other end.

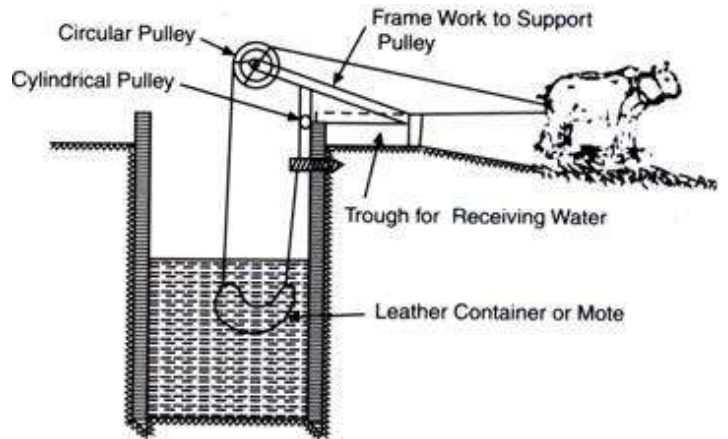


Fig. 17.10. Mote or churus

Figure 4b: Traditional way of getting water from wells -- Mote or Churus

2.2. Commercial Farming:

2.2.1. Introduction:

Contemporary commercial farming solely focuses on the production of crops and farm animals for sale, using the most advanced, efficient, and recent technologies. The practice, also known as agribusiness, is increasingly being taken up and practiced as more and more people partake in it as a lucrative business venture. Due to this, a lot is invested in terms of capital, manpower, and land, making commercial farming the main driver and influencer of the global agriculture industry. In this farming pollution & health hazards are higher.

Commercial farming is all about the growing of crops and/or the rearing of animals for raw materials, food, or export, particularly for profitable reasons. In order to achieve the economy of scale, therefore, commercial farming needs to be very efficient and practiced on a large scale as the goal of the farmer is to maximize the profit margin. As a result, lots of fertilizers, insecticides, weed killers and pesticides are used during farming. It also uses a lot of water. This is export oriented production system to other regions or countries, where their demand is high. For instance: (1) Most Gulf nations rely on food imports since the climate in such countries can't support agriculture; & (2) In few other countries, mass imports are used as raw materials in industries.

Here the wastage is substantially high. It requires lot of capital to get it running. The capital is used to purchase farm materials such as seedlings or seeds, fertilizers and pesticides, machinery, the farm itself, and in paying for the expenses incurred such as water and electricity bills, and in paying for labour, and expertise. It uses



high doses of modern inputs and high yielding varieties of seeds, chemical fertilizers, pesticides, weed killers, and insecticides. This is done to obtain higher production but has detrimental effects on environmental sustainability. Thousands of acres of products such as millet, cocoa, bananas, rice, sugarcane, tea, and other products are harvested and sold, mainly as exports to other countries. It requires large supplies of both skilled and unskilled labour. While skilled labour comes from professionals, unskilled labour tends to exploit immigrants and persons who live in absolute poverty. It also requires heavy machinery such as diggers, trailed sprayers, plows, harvesters, and planters just to mention a few to meet the targets and goals in time, as well as meet the skills of the system of production. However, use of such machinery affects the soil and water holding capacity in the topsoil.

It also involve different agricultural practices within the same parcel of land or region, it mainly involves large scale farming of one type of agricultural practice such as aquaponics, beef farming, dairy farming, chicken farming, coffee farming, sugarcane farming, specialized fruit plantation, flower farming, and tea farming among many others in one region or large piece of land: The vast farms of tea in India and Kenya; The coffee plantations in Brazil and India; Banana production in Uganda, Beef farming in the United States, Sugarcane farms in Indonesia and Mexico; etc. The degree of area coverage may vary from one region to the other and one country to other mainly associated with suitable/appropriate local weather and terrain conditions. Commercial agriculture is unique as the farmers can irrigate the land or keep the farm systems under operation all year round. They do not rely on the rains or natural supplies as ordinary farmers do since they have advanced technologies, machines, and artificial growth enhancers to have their crops or animals sustained throughout. Viability of commercial farming depends up on farm sizes in any given country. For example, in India it is very low [the average farm size of less than 2 ha covers 83% according to 2005-06 survey]. With the growth of population this will be further reduced – The average size of land holding decreased from 2.3 ha in 1970-71 to 1.37 ha in 2000-01. In Africa, for 81 countries the average farm size was 85% [for 14 countries it is 80%], for European Union it is 50%.

2.2.2. Types of Commercial Farming:

(1) Grains such as corn, barley and wheat are grown for human consumption and exports. Grain farming is highly mechanized and requires sufficient amounts of land, machinery, equipment and farmers. The farming is outdoors and is seasonal, meaning farmers are exceptionally busy during the planting and harvesting seasons. It is a highly sensitive type of farming, as it used to be practiced during colonial and slavery periods. Large farms, especially in America and its colonies used enforced slave labour to grow and harvest rice, sugar, tobacco, cotton and other farm products, for trade and export. Today, plantation farming continues, but instead of using forced slave labour, workers are paid low wages, which allows them to continue working in such plantations.

(2) There are two types existing for long with animals, (a) one for milk & milk products and (b) the other for meat products. In the first case (2a) the farms solely used to rear cattle, which produce

the milk used to make other dairy products. In Italy animals farmed for dairy include goats, camels and sheep. In the second case (2b) livestock animals are raised for their meat products. The most commonly reared animals are cattle and sheep, although you might find pigs and chicken reared in large numbers as well. Figure 5a & 5b respectively presents the traditional and hybrid cow feeding its calf. Figure 6 presents the feeding buffaloes in group.

Milk production across countries showed wide variations (Figures 5a&b). Globally, in 1970 it was 391.95 mto and in 2018 it reached to 843.04 mto [million tonnes]. They are respectively for India 20.80 to 187.26; USA 53.07 to 98.72; Pakistan 7.45 to 45.79. China, Brazil, Germany & Russian Federation reached around 30-35 mto in 2018. That means India is the world's largest milk producer, with 22% of global production, followed by United States of America, Pakistan, Brazil and China, etc. Global milk share by animal are 85% cows, 11% buffalo, 2% goat, 1.4% sheep & 0.2% camel. The top five Buffalo milk producing countries in the world in million metric tonnes are India 70.00, Pakistan 24.37, China 3.050, Egypt 2.61,5 & Nepal 1.888.

In 2021 the total meet production was around 350 mto. China is the top meet producing country with 74.54 mto) and next in order are USA with 43.17 mto), Brazil (22.83 mto), Germany (7.69 mto) and India (6.80 mto). Poultry (mainly Chicken), pig meat [fork] and beef make up over 92% of global meat production. In 2021 poultry – 135 mto, pork – 112.86 mto, Beef & Veal – 70.37 mto & sheep – 16.17 mto.

Livestock ranching is the primary source of beef, poultry and pork meats available in most major urban markets. The United States, Brazil and the European Union are the top producers of beef in the world, accounting for about 47% of the world's beef.



Figure 5a: Traditional way of traditional cow feeding milk to its calf



Figure 5b: Traditional way of Modern hybrid cow feeding milk to its calf

In the Mediterranean countries where the climate within such areas is perfect for growing certain crops such as grapes, figs, dates, and olives. Also, the climate supports horticulture, processing vegetables, and flowers among other crops. In the types above, one single crop or livestock is farmed. However, also both crops and livestock are farmed in the same piece of land. As such, the crops can be grown to feed the animals (Figure 6), and the animals sold for profit. Additionally, animal waste can be used to grow crops. The two live and are farmed side-by-side all year round. A great modern example is Aquaponics. In truck farming, crops that are high in demand are grown. They include apples, lettuce, cherries and asparagus.



Figure 6: Feeding group of Buffaloes

2.2.3. Advantages of Commercial Farming:

It helps improve the infrastructure such as roads, water and electricity of an area or country. It helps the surrounding farming community by these. It is a source of jobs for persons living within

the area. This stimulates the growth of the local economy.

2.3. Corporate Farming:

2.3.1. Introduction:

It is a farming system that uses farmers land on lease and makes the farmers to work in their own land. This system destroys the land structure, local groundwater availability. The environment will be polluted. In this small-scale version is in practice, namely tenant farming but they demand government support. They look at commercial crops farming with greater risk. Suicides are rampant, in India particularly in GM cotton under high inputs. Profits and losses are twins.

However, in true sense, corporate farming is a term that is used to describe an agricultural operation that involves the production of food and food-related products on an exceptionally large scale. This approach is different from the operation of family farm as a business [Commercial farming], in that the corporate approach calls for not only the growing of food products but also the wide range of additional services that are important to the marketing of the foods produced. From this perspective, corporate marketing is not just about agriculture itself, but also all the other components that are found under the broad umbrella of agricultural production, marketing, and distribution.

At the core of corporate farming is the actual production of food and food products wherein considerations for the equipment used in the cultivation, nurture, and harvest of the foods is considered part of the farming effort. Factors such as seed supply, fertilizers and chemicals used to manage the growth of the plants to maturity, and the machinery used as part of the harvest process are all included. In addition, factors such as storage facilities; transport of the finished products to their destinations, and even the marketing and advertising tools used to sell the products are part of the broader scope of corporate farming. It is the large-scale production of food and its subsequent sale and marketing, often to businesses that refine the foods into product lines of their own. This is in contrast to a family farm which grows crops that are not only sold directly to consumers or a specific customer who in turn manufacturers and sells foods products to consumers, but that also makes use of a portion of the foods produced for the family's consumption. It may be international in scope, whereas family farming may be somewhat limited in the geographic area it serves. One of the benefits to consumers is that corporate farming often makes it possible to have access to a wider range of food products than would be possible otherwise. In addition, some of the by-products of the growing process may be made into other types of goods that consumers may purchase. The large-scale operations make it possible to create a wider range of products, reach more consumers, and in general realize larger profits than would be possible otherwise. At the same time, critics of corporate farming state that the advent of this approach to farming has seriously impeded the ability of the family farm to survive. With a smaller potential consumer base and a limited delivery area, farms of this type cannot often compete with the prices offered by corporate farms. The end result is that over time a number of family farms have failed, or had to find ways to augment income in order to survive;

2.3.2. Indian Experiences:



The states of Gujarat, Madhya Pradesh, Karnataka, and Maharashtra have allowed agribusiness firms to buy and operate large scale holdings for R&D, and export-oriented production purposes. Some of the corporate agencies in the state of Punjab are asking for longer lease (20-30 years) of farmers lands for corporate farming. The states of Maharashtra & Gujarat have also enacted laws to allow corporate farming on government wastelands [In India found around 5, 52,692 ha of wasteland] by providing large tracts of those lands [up to 2000 acres each] to agribusiness companies on a long term (20 years) lease. The Chhattisgarh state government is also making available about 20 lakh hectares of land for *Jatropha* (biofuel) cultivation. Under the scheme an individual can lease up to 200 hectares of land at a price of Rs. 100 per hectare per year for the first five years, for subsequent years these rates will be increased.

Andhra Pradesh (AP) Government attempted corporate farming in Kuppam in Chittoor district during 1997-2002 where the proposal was to test the feasibility of large-scale farming through contract farming on lands leased by Agribusiness Company [BHC Agro India Private Ltd. – an Israeli consultant firm]. The focus was on precision farming, drip irrigation and quality standards. This is part of replicating Israeli model of modern farming. The AP Government in its Vision -2020 proposed to extend this to backward districts of Anantapur, Mahbubnagar, Ranga Reddy and Vijayanagaram [over 10,000 ha each]. Congress Legislative Party (CLP) released a black paper [prepared by me on the request of CLP Leader] to counter the white paper on agriculture released by the government, wherein brought out the weakness in the corporate farming and proposed cooperative farming in the Indian context. Corporate farming failed at Kuppam; farmers who leased their land became labourers in their own land; Deep bore-wells affected existing bore-wells around the farm; soil structure changed with deep ploughing with heavy machines; and the entire environment including animal husbandry around this was destroyed. The soil porosity changed and as a result the water retention capacity in root zone diminished. Kuppam proposal can be said in just one sentence: “Technically unsound, environmentally hazardous, economically unviable and socially destabilising”. We must remember the fact that the conditions prevailing in Israel are quite different in AP.

2.3.3. United States of America [USA] Experiences:

In USA corporate consolidation in the agricultural sector has built the wealth and power of agribusiness firms while disempowering farmers and rural communities. Corporate farms can often recoup losses through government stock buybacks – past reports show such excess productions were dumped in the ocean -.

In USA, two types are practiced on large farms, namely farmers and corporates wherein the former is termed as commercial farming and the later as corporate farming. The USA farming landscape has changed dramatically over the last century with the rise of corporate industrial farming. Supported by technological advances and government subsidies, the corporate farming sector causes widespread damage to the environment, perpetuates animal abuse, and harms both farmers and consumers. USA corporate industrial farming consistently seeks to maximize profit as they consider food merely commodity with little or no consideration for agriculture’s impact on animals, the

environment, and the people who produce and consume the nation’s food. Corporate farming can also encompass corporations that do not actively manage farmland but are part of farming supply chains, including agrichemical companies, farming equipment companies, and information technology companies. Same is the case with GM cotton seeds in India, which was monopolized by multinational Western Companies.

Farmers in the USA can select from several legal structures to sell goods, pay taxes, and receive government subsidies. Depending on their needs, farmers may choose to form single proprietorships, partnerships, or corporations. Incorporating can offer certain benefits to farmers, including employee benefits programs, financial risk management, and the intergenerational transfer of assets. Compared to unincorporated farms, corporate farms tend to be much larger in terms of acreage, production volume, and investments in farm equipment. In common parlance, corporate farming is linked to industrial agriculture and the increasing power of agribusiness in rural economies. Multinational firms, including meat producers, processed food brands, and seed and chemical companies, have come to dominate the US agricultural landscape through vertical and horizontal integration, contract farming, and acquiring smaller competitors. Corporate consolidation in the agricultural sector has built the wealth and power of agribusiness firms while disempowering farmers and rural communities.

Corporate farming entities in the USA also wield significant political influence to secure favourable environmental and economic regulations for their industry. In what food system scholar and author Marion Nestle has termed “revolving door” politics, there is a significant crossover between government and industry that transfers knowledge and priorities. Regulators often leave jobs in government to work for agribusiness firms, and agribusiness executives advance into positions as government officials. This close relationship between firms and the US regulatory process enables agribusiness corporations to minimally comply with regulations while also limiting the likelihood of future regulations that will harm their profits. This regulatory capture allows agribusiness to pursue agricultural practices that degrade the environment, disrupt the social fabric of farming communities, and harm public health. Exactly the same is the case with GM seed in India.

According to the 2017 census of agriculture taken by the USDA’s National Agricultural Statistics Service, nearly 96% of USA farms are family-run, including those considered “large” and “very large.” These larger family farms total nearly 200,000 farms and account for over 63% of the value of all products sold. Corporate farms growing field crops tend to use industrial practices that give them the ability to out-produce smaller farms or those practicing sustainable or organic techniques. For example, the large-scale monocrops common in corporate farming would be impossible without the use of synthetic agrichemicals, including fertilizers that supplement depleted soils, herbicides that suppress weeds and pesticides that allow large areas of land to be planted with the same species without being decimated by insect pests. Industrial methods have allowed farms to produce higher yields in both field agriculture and animal farming while expending fewer resources on associated expenses such as crop maintenance, animal living space, and farmworkers’



salaries. Between monocrops and concentrated animal feeding operations (CAFOs), corporate industrial farms have benefitted from much higher economies of scale, squeezing out smaller competitors. In the 1990s, smaller independent farms produced nearly half of the total agricultural output in the US, a figure that has dwindled to less than a quarter today.

Government commodity crop and meat production subsidies intensify the decoupling of market forces from prices. The result is prices that are sometimes even lower than the costs of production, a perverse price point that drives smaller independent farms out of business. Corporate farms can often recoup losses through government stock buybacks – past reports show such excess productions were dumped in the ocean --, making this upside production model profitable at large scales. Farmers who are priced out of business often sell or lease their land to larger corporate farms, allowing corporate giants to grow larger. In addition, corporate food and agriculture companies, along with the seed and chemical giants who enable their operation, often merge or acquire one another to capture more market share and increase efficiencies of scale. This is seen clearly in India with reference to GM seeds – they control market and thus non-GM seeds were not allowed to market.

For farmworkers, corporate farming causes additional harm. Jobs in CAFOs and meat-packing facilities are low-paying and highly dangerous, attracting a workforce comprised largely of recent immigrants, undocumented workers, and BIPOC who face systemic discrimination that often leaves them with few alternative employment options. The monocrops and CAFOs of corporate farming are very damaging to the environment. Applying vast amounts of agrichemicals to monocrops can reduce soil fertility, promote soil erosion, and pollute local waterways, sometimes resulting in dead zones, which can cause widespread death for marine creatures. Corporate industrial animal farming pollutes land, water, and air. The confined conditions of corporate industrial agriculture are cause untold suffering among the farmed chickens, cows, pigs, sheep, and fish of the USA food system.

2.3.4. Europeans Experiences:

Ukraine and Russia have many large corporate farms (agro-holdings). It is not uncommon for a single agro-holding company to manage over 80,000 hectares (200,000 acres) of land; however, there are still many family farms throughout Europe. For example, in Poland, family farms are typically less than 40 hectares (100 acres). In comparison, the average farm size in the United States in 2012 was 434 acres, according to the 2012 Census of Agriculture. There is a significant gap in corn yield between the United States and Europe. According to the USDA, corn yield average in 2015 was approximately 70% higher in the United States compared to Europe, Ukraine, and Russia. This is due to several factors, such as different and fewer corn hybrid choices, lower quality fertilizer, fertilizer practices, potentially poor quality and condition of farm equipment. Farming is migrating towards adopting Western farming practices. This is especially true in the large agro-holdings which are becoming quite modernized, to include farm information management and planning. This is done through data collection and field mapping, improved crop rotation practices, improved soil health through

soil sampling/testing, improved fertilizer quality, prescription fertilizing and seeding, and precision metering and planter automation.

2.3.5. Summary:

Corporate farming is the practice of large-scale agriculture on farms owned or greatly influenced by large companies. This includes corporate ownership of farms and selling of agricultural products, as well as the roles of these companies in influencing agricultural education, research, and public policy through funding initiatives and lobbying efforts.

In Canada, 17.4% of farms are owned by family corporations and 2.4% by non-family corporations. In Canada (as in some other jurisdictions) conversion of a sole proprietorship family farm to a family corporation can have tax planning benefits, and in some cases, the difference in combined provincial and federal taxation rates is substantial. Also, for farm families with significant off-farm income, incorporating the farm can provide some shelter from high personal income tax rates. Another important consideration can be some protection of the corporate shareholders from liability. Incorporating a family farm can also be useful as a succession tool, among other reasons because it can maintain a family farm as a viable operation where subdivision of the farm into smaller operations among heirs might result in farm sizes too small to be viable.

The 2012 USA Census of Agriculture indicates that 5.06% of USA farms are corporate farms. These include family corporations (4.51%) and non-family corporations (0.55%). Of the family farm corporations, 98% are small corporations, with 10 or fewer stockholders. Of the non-family farm corporations, 90% are small corporations, with 10 or fewer stockholders. Non-family corporate farms account for 1.36% of USA farmland area. Family farms (including family corporate farms) account for 96.7% of USA farms and 89% of USA farmland area; a USDA study estimated that family farms accounted for 85% of USA gross farm income in 2011. Other farmland in the US is accounted for by several other categories, including single proprietorships where the owner is not the farm operator, on-family partnerships, estates, trusts, cooperatives, collectives, institutional, research, experimental and American Indian Reservation farms. In the USA, the average size of a non-family corporate farm is 1078 acres, i.e. smaller than the average family corporate farm (1249 acres) and smaller than the average partnership farm (1131 acres).

Family farms across Europe are heavily protected by EU regulations, which have been driven in particular by French farmers and the French custom splitting land inheritance between children to produce many very small family farms. In regions such as East Anglia, UK, some agribusiness is practiced through company ownership, but most large UK land estates are still owned by wealthy families such as traditional aristocrats, as encouraged by favourable inheritance tax rules.

Most farming in the Soviet Union and its Eastern Bloc Satellite states was collectivized. After the dissolution of those states via the revolutions of 1989 and the dissolution of the Soviet Union, decades of de-collectivization and land reform have occurred, with the details varying substantially by country. In Russia, some



amount of family farming has developed, but many former collective farms (kolkhozy) and state farms (sovkhozy) retained their collective/joint nature and instead became corporate farms with stock ownership, the farmers having incorporated.

Corporate farming has begun to take hold in some African countries, where listed companies such as Zambeef, Zambia are operated by MBAs as large businesses. In some cases, this has caused debates about land ownership where shares have been bought by international investors, especially from China. Some oil-rich middle east countries operate corporate farming including large-scale irrigation of desert lands for cropping, mostly through partially or fully state-owned companies

In USA farmers based traditional farming [on limited areas] & commercial farming [on large areas] is unable to compete with high profile corporate farming handled by corporates that controls all components of production & marketing under heavy government subsidies and during glut in production government buyback the stocks of major food grains and simply dump in the Oceans. Also, this system of agriculture causing severe pollution in terms of air, water, soil & Food and destroying animal husbandry along with birds in those areas that used to work as biological control on pests.

In India this is not the scenario. Corporates control chemical inputs & seeds. Corporate farming is working on wastelands provided by the governments. The system of corporate farming on farmers lands [on lease through the governments' intervention] tried at Kuppam and it was a disastrous experience. The major issue in India is with Genetically Modified [GM] Seeds. These seeds have short life and creating new pests & diseases and thus causing cost escalation as controlled entering in to market the non-GM seeds. Four multinational Companies monopolized global GM seed industry with local governments' patronizing them.

2.4. Contract Farming:

2.4.1. Introduction:

Contract farming is nothing, but a system of agricultural production carried out according to an agreement between a buyer and farmers. The farmer agrees to provide agreed quantities of a specific agricultural product that meet the quality standards of the purchaser and be supplied at the time determined by the purchaser and in turn, the buyer commits to purchase the product and, in some cases, to support production through, for example, the supply of farm inputs, land preparation and the provision of technical advice. However, there are several contract farming business models, namely informal model, intermediary model, multipartite model, centralized model, nucleus estate model, etc.

Under contract farming, agricultural production (including livestock and poultry) can be carried out based on a pre-harvest agreement between buyers (such as food processing units and exporters), and producers (farmers or farmer organisations). The producer can sell the agricultural produce at a specific price in the future to the buyer as per the agreement. Typically, the farmer agrees to provide agreed quantities of a specific agricultural product. These should meet the quality standards of the purchaser and be supplied at the time determined by the purchaser. In turn, the buyer commits to purchase the product and, in some cases, to

support production through, for example, the supply of farm inputs, land preparation, and the provision of technical advice. It is mechanism to coordinate agricultural production and trade, and its use has increased noticeably in recent years. It is associated with recent transformations in food and agricultural systems which make it increasingly difficult to meet consumer demands under more traditional, open market-based procurement strategies. It may take several forms depending on many factors, from the perspective of the global environment and the particular conditions of the transaction involved. There are significant differences between the world's regions and countries, and their level of economic development, which influences the structure of the agricultural sector and markets. It is intended to provide farmers with the assured sale of their crops and agro-business commercial firms with a steady supply of agricultural output required by the market. It is a commitment of a landowner or a farmer to provide to a known buyer a specified agricultural commodity, at a specified time, price and quantity. Usually, the buyer (the agro-business firm) will control the production process by adding additional provisions, such as technical support and credit. Consequently, it enables poor farmers to transform from outdated cultivation and management practices to market-oriented commercial production, resulting in generating employment and growing income;

2.4.2. Experiences in India:

National Agricultural Policy (NAP) of Government of India announced in 2000 envisaged that "Private sector participation in agriculture shall be promoted through contract farming and land leasing arrangement (corporate farming – TDP a partner of BJP proposed under vision 2020) to allow accelerated technology transfer, capital flow and assured markets for crop production. This was formalised by NITI Aayog with draft model contract farming law titled Agricultural Produce and Livestock Contract Farming (Promotion and Facilitation) Act, 2018. PM announced, "With this farmers income will double". NDA government observed this is in continuation of previous UPA/Congress government. However, previous UPA government proposed in its 2011 budget to establish go-downs & food processing units at local level. These not only provide employment to locals but also help farmers to participate in this. Also proposed direct transfer of fertilizer subsidy to farmers directly – hither to it was transferred to industry. It is not Contract farming. They presented higher year-wise steps in MSP and fertilizer supply by increasing the subsidy component. Anybody can see this from Agricultural Statistics. The present NDA/BJP government brought out three Agri Bills in 2021 [Reddy, 2021a&b] – one of it relates to contract farming – with severe protests from Farmers groups the government withdrew these bills in 2022.

According to the contract, the farmer requires to plant the contractor's crop on his land and to harvest and deliver to the contractor a quantum of produce, upon anticipation yield and contract acreage. This could be at a pre-agreed price. Towards these ends, the contractor supplies the farmer with selected inputs, including the required technical advice. Thus, the contractor supplies all the inputs required for cultivation, while the farmer supplies land and labour. However, the terms and nature of the contract differ according to variations in the nature of crops to be grown, agencies, farmers, and technologies and the context in



which they are practised. Contract Farming is fast evolving as a mechanism of alternative marketing in the country. Punjab, Karnataka, Maharashtra, Madhya Pradesh, and Tamil Nadu have been the front runners in this regard. The experience of contract farming in India shows that there is a considerable saving in the consumption of inputs due to the introduction of improved technology and better extension services. Contract farming has usually allowed the farmers some form of credit to finance the use of production inputs. For example, contract farming in wheat has practice in Madhya Pradesh by Hindustan Lever Ltd (HLL), Rallis, and ICICI. Under the system, Rallis supplies agri-inputs and know-how, and ICICI finances (farm credit) the farmers. HLL, the processing company, which requires the farm produce as raw material for its food processing industry, provides the buyback arrangement for the farm output. In this arrangement, farmers benefit through the assured market for their produce in addition to timely, adequate, and quality input supply including free technical know-how; HLL benefits through supply-chain efficiency; while Rallis and ICICI benefit through assured clientele for their products and services. The consortium is also planning to rope in other specialist partners including insurance, equipment, and storage companies.

2.4.3. Experiences in USA:

This form of farming is widely in use in the production and sale of agricultural commodities. In 2017, 49% of the value of livestock production that rise under contract agreements, usually between farmers and processors. Contracts governed 21% of the value of crop production. The share of crops produced under contract has declined in recent years as farmers turned to other methods for managing risks. Contracts provide farmers with one tool for managing income risks; others include diversification, hedging through futures markets, and investing in storage. Farmers also use contracts to obtain compensation for higher product quality, create specific outlets for products, and assure for debt financing. Moreover, processors use contracts to maintain timely flows of products with desired attributes and greater control over the characteristics and consistency of the products they acquire. Only 8.1% of farms use contracts. Small family farms—those with less than \$350,000 in sales — accounted for 88.8% of all farms in 2017 and 54.3% of farms with contracts. Large-scale family farms, with at least \$1 million in sales, amounted to 2.8% of farms and 14.6% of farms with contracts. Several states have enacted specific laws regulating contract farming. Further, as an example, in 1990, Minnesota became the first State to enact legislation specifically and directly governing agricultural production contracts. Additionally, the law includes requirements on the language and form of the contract, contract formation, and review, and dispute resolution, among other topics. In Morocco, the act covering contract farming provides a list of mandatory clauses that must be included in any contract farming agreement. These include, for example, price and payment, standards concerning minimum quality of the goods, delivery rules, the obligation of each party to keep records, and the nature of the assistance that contractors should provide to the producers.

2.4.4. European Union:

Around half the EU's land is farmed. This makes farming very

important indeed for our natural environment. Farming has contributed over the centuries to creating and maintaining a variety of valuable semi-natural habitats. Further, today, these shape the many landscapes throughout the EU and are home to a rich variety of wildlife. Farming and nature influence each other. The Common Agricultural Policy (CAP) was launched in 1962, is a partnership between agriculture and society, between Europe and its farmers. Its main aims are to improve agricultural productivity so that consumers have a stable supply of affordable food. With the successive reforms of the CAP, our farming methods are becoming more environmentally friendly. Today's farmers, therefore, have two roles – producing our food and managing the countryside. In the second of these, they provide public goods. The whole of society – present and future – benefits from the countryside that carefully manages and well looked after. Further, it is only fair that farmers will reward by the CAP. The EU has 500 million consumers and they all need a reliable supply of healthy and nutritious food at an affordable price. Moreover, the economic environment is set to remain uncertain and unpredictable. Moreover, there are many current and future challenges including global competition, economic and financial crises, climate change, and rising costs of inputs such as fuel and fertiliser. To meet these challenges the EU has created and implemented the CAP. Its purpose isto set the conditions allowing farmers to fulfil their multiple functions in society – the first of which is to produce food. Europe's citizens enjoy food security. We can be sure that our farmers produce the food we need. They provide an impressive variety of abundant, affordable, safe, and good-quality products. The EU is known throughout the world for its food and culinary traditions. Due to its exceptional agricultural resources, the EU could and should play a role in ensuring the food security of the world at large. Many jobs in the countryside are linked to farming. Farmers need machinery, buildings, fuel, fertilisers, and healthcare for their animals. Many people have jobs in these 'upstream' sectors. Other people are busy in 'downstream' operations – such as preparing, processing and packaging food. Still, others will involve in food storage, transport and retailing. Farming and food production are essential elements of EU's economy and society. With its 27 member states, the EU has some 14 million farmers with a further 4 million people working in the food sector. The farming and food sectors together provide 7% of all jobs and generate 6% of European gross domestic product. CAP helps young people to get in farming with funds to buy land, machinery and equipment. It also provides grants to train both new entrants and established farmers in the latest technical production methods. In some parts of Europe, farming is particularly difficult – as in hilly, mountainous, and/or remote areas. It is important to keep communities alive in these regions. The CAP provides funds to ensure that rural communities in vulnerable areas remain in the good economic health and do not gradually disappear. In ancient Greece was the widespread practice with a specified percentage of particular crops. During the first century, China also recorded various farms of sharecropping. In the USA as recently as the end of the nineteenth century, i.e. further, in the first decades of the twentieth century, formal farmer corporate agreements established colonies controlled by the European power. For example, Gezira in central Sudan, farmers will contract to grow cotton as part of a larger land tenancy agreement. There are several benefits and risks to contract farming for the producer and the buyer.



2.4.5. Summary:

Increasing income through long-term and stable access to more remote; Further, lucrative markets and a transparent pricing mechanism, as well as access to new technologies; Improved inputs, technical assistance, and credit facilities. Importantly for the producer, contract farming, can allow them to obtain these benefits; The key benefits for the buyer are controlling commercial risks by agreeing on a price; Controlling production risks by securing a stable supply of agricultural produce in the required quantity and quality and often produced using a specified method; Access to land is also an important motivation for the buyer. Therefore, through contract farming, the buyer can indirectly access land. It is not available for purchase or lease for integrated production business models.

3. Conventional Farming with different ingredients and forms:

3.1. Introduction:

With the time Conventional farming took different shapes and shades in terms of inputs and integrating farmers into groups to minimise the risks associated with weather aberrations.

3.2. Cooperative Farming:

3.2.1. Basic concepts:

Cooperative farming is nothing but conventional farming but in the later individual farmer is involved in the farming and in the former farmers form a group and carry out farming. In this context two concepts are discussed, namely Tagore's cooperative concept and authors concept. The typical small farmer, indebted and impoverished, was much in need of such a structure. "Imagine if all of our small farmers farmed their land collectively, stored their produce in a common facility and sold them through a common mechanism..." Only then can we prevent profiteering; only then can the farmer recoup the legitimate value of her labour, wrote Tagore.

In a set of essays written between 1915 and 1940, Rabindranath Tagore articulated a social vision where exploitation would give way to a just, humane, collectively owned economy. At the core of his thought was the cooperative principle. Written some eight decades ago Tagore's thoughts stemmed from these concerns "the growing concentration of economic power and the destruction of rural India". Instead, he sought an ethical model of production. What would that entail? Tagore's vision went far beyond notions like 'social responsibility' that are in vogue today. To him, ethical production required that resources (such as land and capital) are collectively owned by producers themselves. This would ensure that the produce is also collectively owned, and that all producers have a say in determining their share of value in the product of their work. As Tagore had foreseen it, the cooperative principle enables the most marginalized people to mobilize their most abundant resource: their productive power and their solidarity. 'Development projects or paternalistic policy models for 'empowering the poor' cannot achieve this. The choice is not between textbook theories. The lessons of everyday life have been stark, more so since 2008. The choice is between two different worlds: one driven by hyper-profit and mass distress, the other holding out the promise of shared prosperity and well-being. "

Dr. Y. S. Rajashekara Reddy as the opposition leader [CLP] prior to becoming the Chief Minister of the state of Andhra Pradesh in India in 2004 asked the author to prepare 'black paper' to counter the Chief Minister N. Chandrababu Naidu government's 'white paper' on agriculture during 2001. The author prepared and submitted to him, which was released to press on 15th February 2001 in the Assembly press gallery, wherein the author was also present along with all opposition political parties MLAs. Let me quote one of the press reports appeared in 16th February 2001 edition with the heading "Cong advocates cooperative farming": "The Congress legislature party (CLP) on Thursday charged that the 'Strategy paper on agriculture', released by the state government, was aimed at paving the way for corporate agriculture at the expense of lakhs of farmers and farm workers in the state.

The 'black paper' on agriculture, to counter to the strategy paper, apprehended that the proposed corporate agriculture, if allowed to take over the farm sector, would further widen the rich-poor gap. The Congress contended that farmers would become coolies on their own lands, should the multinational and corporate companies be permitted to undertake corporate agriculture? The strategy paper did not make any mention of a spate of suicides by farmers across the state as a result of an unprecedented crisis in rural economy. Even as the farmers in the state required a credit facility to the extent of Rs. 36,000 crore, the strategy paper promised to arrange only Rs. 6,000 crore from the nationalized banks and financial institutions. Consequently, the farmers were constrained to depend on private money lenders for the rest of financial assistance and at higher interest rates. Thus, entangled in a debt-trap, some of the farmers could find remedy by committing suicide, the Congress leader said. The steep hike in the power tariff and erratic power supply also contributed to the farmers' misfortunes, he said. In this backdrop, the solution lay not in corporate agriculture, but cooperative farming, he said and stressed the need for the government to encourage the latter approach and ensure remunerative prices for agriculture produce."

The corporate farming was advocated at the behest of World Bank and MNCs of the West, as a trial it was undertaken in Kuppam, which resulted in a big failure. When Congress took over in 2004, they announced that the government's intention of introducing cooperative farming. Unfortunately the consultant who prepared the document with title "AP Government proposed cooperative farming" but text dealt with corporate farming. Unfortunately, the advisor to the government earlier was associated with World Bank and Western MNCs. The farmers rejected this. The author exposed this by writing to the chief minister as well presenting in press. The chief minister expressed willingness to review the proposal but unfortunately, he died in an accidental accident. Before this, the author presented this concept in several local print media on the concept of cooperative farming. Later governments closed the issue but announced organic farming natural farming.

The author's letter to CM was published in The New Indian Express --- The author in fact proposed cooperative farming with organic inputs as back as 2001 to AP State Government. The author wrote a letter to Chief Minister YS Rajasekhara Reddy that the cooperative farming should not be corporatized. 'Farmers themselves should form into groups and decide the crop pattern



according to the local weather conditions. Mechanisation of farming should not be allowed as it would not help the farmers' as ours is a highly variable weather.' --- He suggested to the government to have a legislation to bring small and marginal farmers and the landless who received land from the government under cooperative farming as an environment-friendly solution to improve production to meet the food needs of the growing population as well as improve the standard of living of the rural poor. He also spoke against mechanisation of agricultural operations and surrender of land to corporates as around 60 to 65 per cent of rural population, who are directly or indirectly engaged in farming and related activities, might end up as beggars on the street. At best, the government may provide 100 days' labour to them, which denigrates the status of a farmer, as happened in Kuppam, the expert said. The main ingredient of cooperative farming shall be environment-friendly organic inputs that provide quality food - this will bring down government's subsidy component on chemical inputs given to industry and the same could be better utilised in making the scheme successful. As Tagore advocated few decades back, cooperative farming system of agriculture is the only solution under the present volatile political and climate conditions to achieve sustainable production by farmers' and thereby strengthen their economic conditions and as well nation's economy.

Few other ingredients: Organic or natural farming or not systems of farming but they are ingredients in terms of fertilizers in to conventional & cooperative farming systems. In conventional farming farmyard manure mixes with dung + urine + fodder waste in overnight and this was put in to pit in the morning to decompose until the start of crop season. In the case of organic farming it artificially created Vermicomposting over a short period of time, but it also uses dung to decompose. Natural farming uses the cow dung and Urine. Here the time period reduced from year to around a month to days.

(1) Organic farming system related issues: The Union Finance Minister Mukherjee [later became President of India] in his budget presentation in 2011 highlighted the importance of organic farming as well storage issues. In 2022-23 budget the same was repeated by Union Finance Minister Nirmala Sitharaman also highlighted importance and announced 5-km stretch along the river Ganga will be organic agriculture zone. Agriculture development is central to our growth strategy. Measures taken during the 2011 have started attracting private investment in agriculture and agro-processing activities. This process has to be deepened further. While the need to maximize crop yields to meet the growing demand for food grains is critical, we have to sustain agricultural productivity in the long run. There has been deterioration in soil health due to removal of crop residues and indiscriminate use of chemical fertilizers, aided by distorted prices. To address these issues, the Government proposes to promote organic farming methods, combining modern technology with convention [traditional] farming practices like green manuring, biological pest control and weed management. The years 2008 to 2010 saw very high levels of food grain procurement. On January 1, 2011, the food grain stock in Central pool reached 470 lakh metric tons, 2.7 times higher than 174 lakh metric tons on January 1, 2007. The storage capacity for such large quantities requires augmentation. Process to create new storage capacity of 150 lakh metric tons through private

entrepreneurs and warehousing corporations has been fast tracked. Decision to create 20 lakh metric tons of storage capacity under Public Entrepreneurs Guarantee (PEG) Scheme through modern silos has been taken. While we will be able to add about 2.6 lakh tons of capacity by March 2011, based on existing sanctions, the addition will reach 40 lakh tons by March 2012.

During 2010-11, another 24 lakh metric tons of storage capacity has been created under the Rural Godown Scheme. Investment in cold storage projects is now gaining momentum. During this year, 24 cold storage projects with a capacity of 1.4 lakh metric tons have been sanctioned under National Horticulture Mission. In addition, 107 cold storage projects with a capacity of over 5 lakh metric tons have been approved by the National Horticulture Board. To attract investment in this sector, henceforth, capital investment in the creation of modern storage capacity will be eligible for viability gap funding scheme of the Finance Ministry. It is also proposed to recognize cold storage chains as an infrastructure sub-sector. Strengthening such facilities will in containing post-harvest loss.

3.2.2. Natural Farming:

Zero-budget natural farming (ZBNF), popularised by Maharashtrian agriculturist and Padma Shri recipient Subhash Palekar, refers to the process of raising crops without using chemical fertilisers and pesticides or any other external materials. Instead, farmers use low-cost locally sourced natural concoctions, inoculums and decoctions based on cow dung, cow urine, jaggery, lilac, green chillies and many other such natural ingredients. The term 'Zero Budget' means the zero cost of production of all crops. ZBNF guides the farmers in practising sustainable farming that helps in retaining soil fertility to ensure chemical-free agriculture and ensure low cost of production (zero-cost).

This climate-resilient agricultural method, which is different from organic farming, aims at promoting agroecology and adopting low-cost agriculture practice wherein all critical inputs are gathered from the field and nothing is introduced from outside. Under ZBNF, neither fertiliser nor pesticide is used and only 10 per cent of water is to be utilised for irrigation as compared to traditional farming techniques. The basic concept of ZBNF is to ensure that profit from supplementary crops is enough to cover the cost of production of the main crop and it has the potential to enhance the income or profit margins for farmers who are often under distress owing to debt. It has few components, namely: A composition of cow dung and cow urine, jaggery, pulse flour, water and soil is applied on the farmland; a mixture of neem leaves and pulp, tobacco and green chillies prepared for insect and pest management, that can be used to treat seeds; A traditional mulching that protects topsoil during cultivation and does not destroy it by tilling; Condition where there are both air molecules and water molecules present in the soil and thereby, providing water to maintain the required moisture-air balance. The government of India promoting organic farming through the schemes of Paramparagat Krishi Vikas Yojana (PKVY) since 2015-16 and Rashtriya Krishi Vikas Yojana (RKVY); Under the PKVY scheme, several organic farming methods like zero budget natural farming (ZBNF), natural farming, vedic farming, rishi farming, cow farming, homa farming, etc. are included wherein states adopt any model of organic farming including ZBNF



depending on the farmer's choice; According to the RKVY scheme, organic farming or natural farming model components are considered by the respective State Level Sanctioning Committee (SLSC).

3.2.3. Health per acre concept:

FAO in 2011 released an edited book titled "Climate Change and Food Systems Resilience in Sub-Saharan Africa". In this, it states that "Ecological agriculture holds significant promise for increasing the productivity of Africa's small holder's farmers, with consequent positive impacts on the food security and food self-reliance. Crop yields of major cereals and pulses have almost doubled using ecological agricultural practices such as composting, water and soil conservation activities, agro-forestry and crop diversification. The use of chemical fertilizers steadily decreased. The green revolution system has shown that increase in yields doesn't necessarily translate into food security. That is, technological strategy does not guarantee food security or even social security. The so-called success of the green revolution system was due to heavy government incentives in terms of providing subsidies, building infrastructures and providing guarantee for credits. It is not a sustainable agriculture. We must look at reduction of hunger and poverty, improvement of rural livelihood and human health, and equitable, socially, environmentally and economically sustainable development. In sub-Sahara Africa only 4% of agricultural land is irrigated compared to 37% in Asia and 15% in Latin America. Sustainable and ecological agricultural approaches, including organic agriculture, can be in many forms, but generally integrate natural, regenerative processes; minimize non-renewable inputs (chemical inputs); rely on the knowledge and skills of farmers and depend on locally – adapted practices to innovate in the face of uncertainty. It is also biodiversity based. Thus, organic agriculture is a production system that sustains the health of soils, ecosystems, biodiversity and people." However, this book also used climate change as an adjective like many others and did not delve into realms of the climate change the agriculture. A new report from Navdanya, called "Health per Acre," was released in New Delhi in March by Syeda Hameed, a member of the Indian Planning Commission, whose chairman is Prime Minister Dr. Manmohan Singh. According to the report, "a shift to biodiverse organic farming and ecological intensification increases output of nutrition while reducing input costs." Agricultural output should be measured in terms of "'Health per Acre' and 'Nutrition per Acre' instead of 'Yield per Acre,'" the report says. The paper said that "this should be the strategy for protecting the livelihoods of farmers as well the right to food and right to health of all our people." Vandana Shiva, the Indian environmentalist and advocate who founded Navdanya, claims that organic farming produces more food and nutrition than conventional methods. Through intercropping, one organic farm could produce 900 kilograms of food per acre, including 400 kilograms of corn and 500 kilograms of beans and other crops, according to Navdanya's studies of the farms of its members. A comparable conventional farm growing one crop would yield 500 kilograms of corn but would lose the other products. Organic farming produces "twice the amount of nutritional needs by intensifying biodiversity rather than monoculture and chemicals," Ms. Shiva said. These show that there are several types of organic farming are in use world over under different names but with the same basic concept.

3.2.4. Growth concept:

The Hindu reports that "Area under organic farming has grown many-fold in six years to 2009-10 in India on the back of thrust given to the chemical-free mode of cultivation. Official figures state that from 42,000 hectares under organic certification in 2003-04, more than 4.4 million hectares area was under organic certification in the country as on March 2010. For quality assurance, India has internationally acclaimed certification process in place for export, import and domestic markets. During 2008-09, India produced about 18.78 lakh tons of certified organic products. Of this, nearly 54,000 tons food items worth Rs. 591 crores were exported. With more than 77,000 tons of organic cotton lint production, India became the largest organic cotton grower in the world a year ago. Indian organic exports include cereals, pulses, honey, tea, spices, oil seeds, fruits, vegetables, cotton fibre, cosmetics and body care products. The Ministry of Agriculture is promoting organic farming in the country under National Project on Organic Farming, National Horticulture Mission, and Technology Mission for North East and Rashtriya Krishi Vikas Yojana. National Project on Organic Farming is being implemented since October 2004 through a National Centre of Organic Farming at Ghaziabad and six Regional Centres located at Bangalore, Bhubaneswar, Hissar, Imphal, Jabalpur, and Nagpur. The project supports organic input production infrastructure, technical capacity building of stake holders, human resource development through training, statutory quality control of organic inputs, technology development and dissemination, market development and awareness. Under the National Horticulture Mission and Technology Mission for North East, assistance is provided at rate of 50 per cent of cost subject to a maximum of Rs. 10,000 per hectare (up to 4 hectares per beneficiary) for organic horticulture cultivation. Assistance is also provided for setting up vermicompost units at the rate of 50 per cent of cost up to Rs. 30,000 per beneficiary. Assistance of Rs. 5 lakhs are provided to a group of farmers covering an area of 50 hectares for organic farming certification. Under the Rashtriya Krishi Vikas Yojana, States are being assisted for area expansion of organic food crops, capacity building of farmers and organic input production."

3.3. Strengths & Weaknesses:

The report from the U.N. Special Rapporteur on the Right to Food pointed out that the Green Revolution had focused primarily on increasing cereal crops that contain relatively little protein and other essential nutrients. "Nutritionists now increasingly insist on the need for more diverse agro-ecosystems in order to ensure a more diversified nutrient output," it said. But some agriculture experts say that while organic farming has benefits, it cannot make a significant dent in total agricultural demand. Organic farming is an important niche market with big potential near major cities. But it is "not a general solution to malnutrition at all," said Mark W. Rosegrant of the International Food Policy Research Institute in Washington. "You have to put inputs in to get yields. To move fully to organic, you are going to lose productivity." A chapter in the 2006 book "Global Development of Organic Agriculture," co-written by Mr. Rosegrant, said that compared with "high-yielding crops cultivated with the use of fertilizer and pesticides, most organic crops yield less per hectare due to a combination of lower nutrient supply and yield reductions from



weeds, fungi, and insects.” The paper cited a study from 28 countries that found “that on average organic yields are 80 percent of those under conventional agriculture.” They also cite that there are other barriers to the growth of organic farming in India. Organic certification from international agencies is expensive and bureaucratic.

A shift to organic farming requires extensive training and support for farmers who are largely uneducated. Farmers must be connected to markets and shops that sell their goods, usually in cities with wealthy consumers — no small feat in India where roads and infrastructure are poor. Organic food is at least 30 percent more expensive than foods produced by conventional methods. In India, there is no financial support from the government for organic farming, while the majority of fertilizer and pesticide companies are subsidized. But if organic farming reached a greater scale, prices would fall, said Vinod Bhatt, a director of Navdanya. As he led a tour of Navdanya’s tranquil 45-acre farm near Dehra Dun, Mr. Bhatt walked past lush rice fields and explained how ginger and turmeric were grown between rows of corn to retain soil fertility and maximize yield per acre. A botanist by training, Mr. Bhatt said rice should not be grown in successive seasons but should be alternated with peas, wheat, corn and mustard over two years to keep the soil fertile. Marigolds planted on the edge of the field help keep pests away, as do lantana plants and neem trees, and mixtures made of cow urine and worm secretions, he said. Mr. Bhatt joined Navdanya in 1997, and he recalled that interest in organic farming was limited back then. Now, “farmers are coming to us because they can see the results,” he said. He pointed out some okra growing on tall stalks. Mr. Bhatt bent a stem so a visitor could peer at the large green “lady fingers,” as okra is called in India. “I don’t know why people don’t believe organic is more productive,” he said.

3.4. Discussion:

From the above it is clear that the so-called hurdles for organic farming are not really a hurdle once the momentum takes U-turn. There is a need that government must look into providing fertilizer subsidy directly to farmers based on cropped area and farmer should be given freedom in choosing the type of fertilizer: organic or inorganic. To achieve this goal, government must give fertilizer subsidy to farmers or farmers’ cooperatives directly and not to retailers, which are under the clutches of politicians and bureaucrats – mostly benami names. Here the farmers’ have the flexibility to grow crops what he wants or what the market demands. Crop commodity boards must be established based on the needs of different parts of the country that help in the collection and improvement of technology to maximize yields of such crops in mixed or intercropping as well if needed under more crop condition. By this way we can preserve local seed biodiversity for sustainable future use. This must be a part of organic farming structure. Timely crop management is the mantra under this system. Though our country is the largest producer of many kinds of millets, they are not as popular as it should be, given their health benefits. This must be done. The other important component is permaculture which is a sustainable urban food gardening in the light of urban surroundings producing food with polluted water that create innumerable health hazards.

4. Farmers’ Innovations related Issues:

4.1. Introduction:

Funds crunch, lack of adequate assistance from government officials and private sector firms, and lack of awareness among people are the main deterrents in identifying rural innovations as a national movement. Besides being cost-effective and eco-friendly, these potential scientific discoveries need to be commercialized and even exported. The two innovations in paddy cultivation are summarized below. Governments are ready to provide subsidies to the tune of 90% to MNCs seed and technology packages but at the same time governments are reluctant to provide subsidies to indigenous technologies. It is a great pity as we are still living under the colonial legacies! Let us see some of the indigenous innovations.

4.2. Seeds in clay pellets’ technique:

Ram Abhilash Patel from Allahabad, Uttar Pradesh developed a concept of sowing paddy seeds inserted in clay pellets. The farmer claims that he got this idea from within the household. He noticed that children made clay pellets for playing and used to throw them away. Suddenly during monsoon, he noticed a small seedling growing from the wet pellet. This inspired him to try using the same method for growing paddy. Finding the right kind of clay soil posed a problem. Other soil types tend to break under pressure while pushing the paddy seeds into them. The seeds can be easily inserted inside clay and remain safe during sowing and later germinate well. Pond or river soil is mixed thoroughly with 3-4 paddy seeds to make small balls of pellets. The pellets are made during April - May and dry within 2-3 hours. Pond soil is very fertile and helps in minimizing weeds. The farmer is practicing this method for the last 15 years and impressed by it, many others in the region are doing the same. The pellets can be sown manually or by using a seed drill. Rows are made facing east to west or vice-versa so that the germinating plant gets ample air and sunlight. This method saves both time and money and the need to prepare a nursery for paddy plants does not arise. By adopting the conventional nursery method, paddy crops take approximately 160 days to mature while using this technique it takes only about 145 days. Farmers need not wait for monsoon to start sowing under this method. As pond/river soil, is fertile, the dependence on fertilizers is reduced and as the seeds are in a mud shell, they are protected from birds etc. The process also saves water as no standing water is needed in the field. Most importantly, the output gets maximized by this method. Mr. Ram Abhilash proved experimentally by cultivating paddy in a field by all three methods namely pellet, nursery, and direct sowing. The paddy production using these methods was 1.7, 1.5 and 1.4 tons respectively. Though some products are being commercially manufactured and exported, there are millions of ideas such as Mr. Ram's, waiting for assistance in terms of funds, technical and design support.

4.3. System of Rice Intensification [SRI]:

It was invented by French Jesuit Fr Henri de Laulanie in Madagascar in 1983 after 30 years of research. Today it is used in 30 countries including China, Indonesia, India, Sri Lanka, Laos and Cambodia, where research has shown yield increase by 30-50% using half the amount of water. China in particular, is leading the way, using SRI in conjunction with hybrid seeds. India has adopted SRI as one of the components of its food security



program and is promoting the method in 39 districts and is planning to convert 5 million hectares of land into SRI plots in the next five years. With all the advantages it offers, SRI is quite simple, and can be done on local or hybrid varieties alike. Instead of waiting for the seedlings to mature, young plants of 8-10 days are transplanted one by one, allowing the roots to spread out further. They are also planted farther apart, at 20 cms, so that seeds don't have to compete for food and light, and this also reduces the amount of seed required. The field is irrigated just enough, without submerging it in water and water is drained two-three times at an interval of 15 days. This allows bacteria in the soil to improve fertility. A weedier machine and composting mean less pesticides and fertilizers are needed. Traditional paddy-growing submerges fields to control weeds and pests, and the downside of SRI is that it is more labour intensive, requiring more hands for weeding, timely drainage and careful planting. But the benefits in greater harvests far outweigh these shortcomings. SRI produces 150 quintals of rice per hectare for a land that yielded 20 to 30 quintals in the old method, using 35 per cent less water, 10 per cent of seed and 50 per cent less fertilizers. In Nepal, SRI was pioneered by Rajendra Uprety when he was District Agriculture Extension Officer in Morang. He read about it in an agriculture journal and decided to give it a try. Today there are SRI tests and demonstrations being carried out in 35 districts across the country: 300 ha in Dang, 120 ha in Jhapa and 80 ha in Kailali. Test plots like these produce up to 12 tons per hectare, compared to 3 hectares produced by the old method. SRI system provides 100 tillers from a single seedling and traditional system provide only 10 tillers each. SRI also produces sturdier plants with thicker tufts that can withstand floods. Some government officials and the UN's Food and Agriculture Organization are enthusiastic with the trials and say SRI could hold answer to Nepal's food insecurity. A timely monsoon and the winter rains boosted harvests, and Nepal recorded a grain surplus of 111,000 tons this year. However, 38 districts still face food shortages and 41 per cent of the country's population is undernourished. The country needs to feed more with less and SRI seems to be one answer. "If SRI is adopted in a national scale, we can double our rice production with ten per cent the seeds, half the fertilizers and very little water. What could be more perfect?" asks Rajendra Uprety, a government agriculture officer who helped introduced the technique in Nepal. In Morang, 2,000 farmers are regularly using SRI and are happy with it.

4.4. Failure of government agencies:

While the innovations are happening, to increase farm productivity in the country, the government of India has released Rs. 181.35 crore ---- under the Rashtriya Krishi Vikas Yojana scheme to extend green revolution to the Eastern states. Assam, Bihar, Chhattisgarh, Jharkhand, Orissa, Eastern Uttar Pradesh and West Bengal are covered under this scheme with a total allocation of Rs. 400 crores. The programme targets improvement in the rice-based cropping system in the selected states. Though, Eastern India with more rainfall compared to the North-west regions in the country, unexploited good quality ground water aquifers has an advantage for sustainable production of rice, banana, sugarcane and aquaculture, the agricultural productivity in this region is dismally low in spite of the adequate availability of natural resources required for higher production. The scheme aims to increase the crop productivity of the region by intensive

cultivation through promotion of suitable agricultural technologies and practices. This shows how Indian officials work!!! This is also expressed in December 31, 2011 issue of *Down To Earth* Latha Jishnu, Aparna Pallavi & Savantan Bera under "Saving rice".

The authors state that "Rice is at the heart of a fierce strategy debate as the country prepares to launch the second Green Revolution in the eastern states. Policymakers and scientists have drawn up ambitious plans to increase the productivity of this cereal which feeds two-thirds of Indians. Enormous funds are being poured into research aimed at improving seed varieties, with a heavy focus on developing hybrid rice. Is it the right option for millions of small rice farmers who are already battling high input costs and increasingly unpredictable weather? Or does part of the solution lie in efficient methods of cultivation that will cut down water use and improve yield? Latha Jishnu discovers that traditional rice varieties are making a significant comeback in Odisha—as in Karnataka -- As one travels southwest to Koraput, the fields of traditional rice varieties appear to be more widespread --, where Aparna Pallavi finds some farmers have abandoned high-yielding varieties in favour of indigenous varieties and organic farming to meet the challenges of climate change. From West Bengal, Sayantan Bera reports that the largest rice producing state has a different set of problems to contend with if it has to reap the promise of the new Green Revolution.

There is a crisis in rice—both for the farmer, battling unprecedented changes in weather and escalating costs of cultivation, and the government, which needs to ramp up rice production by two million tons annually to ensure the nation's food security. The biggest worry is stagnant yields. India has the largest area under rice in the world—about 44 million hectares (ha)—but its productivity is way behind a dozen other countries. High-yielding varieties cover slightly over 80% of the rice acreage, but the yields of these varieties—the result of decades of research by the huge network of public-funded institutions— have touched a plateau. In contrast, China, the biggest producer of rice in the world, churns out 193 million tons of paddy on just 29.2 million ha, notching up yields of 6.61 tons/ha compared with 3.37 by India.

There lies a huge perception gap between the farmer's search for sustainable livelihood and ecologically sound practices in the face of climate uncertainties and dipping water table, and the government's focus on industry-promoted solutions for boosting rice yield. In 2008-09 the yield (kg/ha)/area (million ha) in West Bengal was 2533/5.94, Andhra Pradesh 3246/4.39, Uttar Pradesh 2171/6.03, Odisha 1529/4.45, Punjab 4022/2.74 and Assam 1614/2.48. At all India level they are: 1950-60 - 829.9/31.57, 1960-70 - 998.9/35.85, 1970-80 - 1156.4/38.63, 1980-90 - 1467.1/40.65, 1990-2000 - 1852.0/43.21 and 2000-10 - 2052.8/43.40. The yield (tons/ha)/area (million ha) in china are 6.61/29.2, in India are 3.37/43.91, in Indonesia is 4.88/11.85, I Bangladesh is 4.01/11.60, in Vietnam is 4.88/7.35, in Thailand is 2.75/10.68, in Myanmar is 2.61/6.70, in Philippines is 3.82/4.40, in Brazil is 4.45/2.92 and in Japan is 6.78/1.63.

But can traditional varieties alone meet the country's growing food needs? The Planning Commission estimates that India requires 122.1 million tons of milled rice by 2020 to meet food



security norms. At the existing 1.34% rate of growth India can hope to produce no more than 106 million tons. To bridge the gap, according to the Union agriculture minister Sharad Pawar the best bet is the Chinese model, particularly in using hybrid paddy. Since the 1990s, the Centre and states have released 43 hybrid rice varieties, of which 28 are developed by public labs; 30-40 truthfully labeled hybrids developed by the private sector are being cultivated in the country. Yet, just about 3% of the area under rice has gone over to hybrids. Farmers don't appear to see much benefit in using hybrids, and there are issues relating to quality and availability of the seed, hybrid rice seed production is a very complex and risky task and the ultimate realization per unit area in hybrid rice is very low. It argued in any case, even with the existing semi-dwarf high-yielding varieties, productivity of four-five tons per ha is achievable. Here we must remember the fact that hybrid seeds and as well GM seeds are tailored to chemical inputs (Reddy, 2003). However, researchers are not looking at yield gaps between countries & between states; and why?

It was pointed out that a significant strategy to enhance rice productivity in rainfed areas and mitigate the impact of climatic changes is to go for stress-tolerant rice varieties. Stress-prone rice area in the country accounts for as much as 24 million ha, of the 44 million ha, posing a huge challenge for stabilizing rice production. It was pointed out that Hybrid seeds cannot be reused by farmers like other seeds and have to be procured each season from the developer and therefore that private seed companies are not interested in inbred seed research but are focusing almost exclusively on hybrids." This entire push for hybrids is to pave way for Hybrid & GM rice in this country and not for the ecological security or economic security for the farmer. The hybrid – GM paddy concept is to monopolize the paddy seed industry by MNCs only. Hither to this was not in the clutches of MNCs. Few years back I participated in a discussion session organized by Synzenta a bio-tech giant in Hyderabad. It was clear at that meet that colour and taste and dietary level are not likable to humans. Also, the fodder will have to be simply burnt as animal don't like such fodder. This is true with all Hybrid fodder.

In India over different parts localized innovations are aplenty. The government must introduce a system to collect such innovations and stabilize the system for different ecological zones to achieve maximum benefits. While projecting the food production they must take in to account the present scenario: How much is produced and How much is wasted and Why? Without this simply paperwork lead nowhere. Because even the Finance Minister in his 2011-12 budget speech talked of wastage by more than 30%. This was also the case at world level [FAO Report]. National project on climate resilient agriculture launched to implement the scheme in 100 districts, which has been promoted by ICAR constituent unit Central Research Institute for Dry-Land Agriculture [CRIDA, Hyderabad] the innovations, appears to be not part of this scheme. The M. S. Swaminathan Research Foundation in association with Indian Overseas Bank planned to implement this through five farm schools in five states where progressive farmers will train other farmers – the transfer of technology is land-to-land hither to it was lab-to-land that failed. Let our scientists come together and assess innovative systems of agriculture and their suitability to different agroclimatic zones. Here it must also be looked into human consumption as well

animal feed context. We must encourage animal husbandry in agriculture to reduce the risk at household level of a farmer. Without this process by simply adapting MNCs technology to benefit them lead to disaster in rural India in the next few decades. The government's economic reforms must shift from urban centric to rural centric that provides alternate income to withstand volatile weather conditions that hither too encouraging rural to urban migration that affecting agriculture.

DC (August 26, 2011) presented a report on "Andhra Pradesh gears up for climate change". This report says that for such study ICAR/CRIDA selected six districts in Andhra Pradesh with 1000 farmers in each. The report starts with the assumption that "crop failure and reduction in yields due to climate change". The basic question here is: was there any study to substantiate this statement or it is a statement from the air as usual or simply using the word climate change as an adjective? The results presented at the end of the report show that they are using weather as climate change and thus attributing the changes associated with weather to climate change. The report says in some parts rainfall is showing decreasing trend and some other parts increasing trend. Though the report also stated temperature increase, but it does not state the increase in temperature is more associated with urban effect or rural agriculture zones effect? This is vital to achieve the goal of the objective stated above.

ICAR's findings (presented at the end of the report) -- temperatures above 35°C and below 23°Cs resulted in pollen sterility in rice -- this is a standard phenomenon (see Reddy,1993) but rice is cultivated in summer, rainy season and winter in low latitudes and high latitudes. That means based on the variety used in a specific zone or season the limits vary. Also, the tolerant limits vary with growth stages – the author carried out such analysis with Sorghum varieties, published in 1984 (Reddy, et al., 1984) --. Grain yield reduction of up to 70% was observed in rice with rise in ambient temperature -- this depends primarily on moisture and then soil & relative humidity. We have seen in AP 2008-09 Rabi season with pumping of Godavari water AP produced bumper production. In the report they state that thermal stress reduced wheat economic yield by 18% and 60% in Mustard. Such results depend upon several other parameters, such as weather, soil parameters and seed variety. But all these refer to weather only. For example, during 2002 & 2009 drought years the temperature has gone up by 0.7 & 0.9°C. Drought, temperature and evaporation (water need) vary and their impact vary with soils, varieties of seed, etc. The rise in temperature under climate change is miniscule when compared to the temperature changes observed in different years and seasons.

5. Summary & Conclusions:

The review summarised on types of farming system practices have existed around the world. The broad farming systems are traditional, commercial, corporates, contract and cooperative. However, in these systems there existed several sub classes based on population, climate, country, irrigation, inputs, technology, commerce, etc. The widely followed system in developing countries is traditional farming, wherein more than 60% population were engaged in agriculture farming related activities directly or indirectly; and while in developed countries where fewer members are in farming are basically following commercial



farming and contract farming. In contract farming the farmers under contract produce what the contract firm wanted as per the agreement – this is seen in tobacco production in India. Corporate farming works exactly in opposite wherein corporate firm takes on lease the lands either from farmers or from government and firm itself cultivates the land. In commercial farming farmer carryout, the job like corporate firm on their lands. However, the Contract Firm put a strict condition that farmers must follow “crop rotation” to protect soils. Pros and cons of the concepts vary with technology, inputs, subsidies, weather, soil, local needs & facilities. Technology, inputs and subsidy components define the air, water, soil and food pollution related issues. Under traditional and organic inputs these are very low or nil but with chemical inputs in all the systems pollution becomes the hallmark and as well government subsidies, cost of production goes up and thus prices in the market also goes up. The best system is that balances these negative components. This is possible under cooperative farming system with organic farming/natural farming with Conventional Farming model.

Agriculture under Traditional Farming systems animal husbandry has been part that provides economic security and healthy diet. The multiple or intercropping with legumes improved the soil condition and provide better fodder to animal. After 1960s, with the entry of chemical inputs technology this was affected severely with monocrop system. Fodder is unsuitable as feed to animal as well the soils degrading, causing air, water, soil & food pollution. This is more so with modern farming related commercial, corporate and contract farming. In all the systems of farming, they primarily look at “profit” through rise in production. They don’t care for the environment or environmental pollution that affects the others. However, in these seeds and chemical inputs beneficiaries’ are multinational companies.

Some farming systems solely work on commercial interest, wherein wastage is high and to compensate these prices in the market soar-up as governments have no control on such firms. The other part of farming is animal husbandry based. This has two components, namely (1) milk & milk-based products and (2) meat based products. Sometimes they form separate entity by itself or mixed with cropping. India is in number one position in milk production and USA is in number one position in terms of meat production. We must remember one important factor, namely around the world the wastage runs around 30-50% and thus inputs to produce that quantity are also going as waste. In cooperative farming this is not so. Let the governments look in this direction to save wastage and input costs. Government must bring out a law for adaptation of cooperative farming with organic inputs; Government must introduce subsidy on organic inputs and seeds on par with chemical inputs and seeds; Government must provide infrastructure, food processing units and storage of produces; Government must implement supply of millets to PDS retail network, etc.

This study is useful to understand food security and food waste studies.

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