

## ANIMATE TO MECHANISED FARMING AND ITS DIMINISHING RETURN

**ANANDITA RANA\***

\*12th class, Delhi Public School, Rohini, Delhi-110085.

Email: ananditarana@gmail.com

### **ABSTRACT**

*The study is based on micro level sequential improvement of agricultural output since 1950. The introduction of technology as farm input and its related problems were discussed in details. It interprets the saga of a farmer's family from rudimentary traditional farming based on bullocks to the shift on tractor, fertilizers and electrified tubewells. The problems of farming transition from high human labour input to low human labour input were linked with commercialisation of crops. It's established the relationship between micro level geographical conditions of village with the selection of crops and its land use intensity.*

*With increased farm infrastructure and crop inputs the cropping pattern also changed from coarse grains to vegetables to subsistence food grain to commercial crops.*

*The dynamic nature of village social conditions and eroding nature of casteism were shown with positive correlation. The localization of village in rural urban fringe played vital role for deviation from rudimentary lifestyle of farmer's family. The situations of farmlands were linked with farmer's enterprising attitude.*

*It's identified the increasing cost of inputs with increased farmland productivity and still leads to the law of diminishing return. Subsequently, farmer's family explored alternate sourced of livelihood with multiple avenues in service, trade and manufacturing sector.*

### **INTRODUCTION**

The Geographical Advantages of sentimentality of north Indian region leads to higher agricultural dependency than the coastal and insular regions. The Western disturbances which yields rainfall during winter seasons in

north western part of India resulted into intensive cropping pattern during rabi (winter) cropping season. The riverine plains, suitable cropping seasons particularly for food grain crops, perennial Himalayan rivers with canal irrigation network and enriched groundwater table to substantiate ensured irrigation in the basin of Ravi, Beas, Satluj, Yamuna, Ganga and Sharda rivers in Punjab, Haryana and Western Uttar Pradesh makes the region as grain basket of country. The historical advantage of land tenancy system and institutional support to the farmers after independence supported the peasant-community to deviate the cropping methodology from traditional-animate-subsistence farming to modern-mechanised-commercial farming.

During late 1960s, the government introduced the high yield variety seeds of wheat as Sarbati, Sonera, Sonalika, HD-1553, C-308 etc. for the rabi season crop to increase the foodgrain production as per the climatic suitability in the country. Simultaneously, diffusion of mechanisation in farming as tractor and electrification up to each farmland to run the tubewells, developing the supply chain of market system and availability of fertilizers brought convincing changes in farming methodology. The introduction of minimum support price along with financial support system of loans to farmers by co-operative, gramin and nationalized banks brought a sea-change in the increasing the production of wheat crops.

The climatic suitability for wheat crop in north western semiarid region proved to be the most significant reason for steep increase in crop production. Wheat require moderate temperature during sowing season ( $20^{\circ}$  C average temperature, - November month), low temperature during growing season (with at least 15 frost full night) and comparatively high temperature during harvesting season ( $25^{\circ}$  C average temp. - March-April month). Subsequently, wheat crop also requires 4 to 5 times irrigation during its 4 months long cropping season, where generally winter rain led by western disturbances substantiated one to two times irrigation which gives great support to farmers to grow wheat. The perennial canal network, rich groundwater reserves in porous sub-soil, subsidized electricity to farmers along with institutional support ensured desired irrigation to rabi crop of wheat in north western states of India where sub-tropical and semi-arid climate boosted the momentum of green-revolution.

Almost after a decade of the diffusion of wheat crop led green revolution in NW India, farmers further intensified the kharif (rainy season) crop of rice which is again a foodgrain (staple) crop. The already developed irrigational network and minimum support price protected marketing system supported the farmers to grow rice crop as rice was the non-conventional crop in this semi-arid climate. Before green revolution the share of rice in net sown area was less than 5%. The combination of wheat (rabi season winter crop) and rice (kharif season rainy crop) which

are both the foodgrain (staple) crops, shifted the economic paradigm of farmers from subsistence farming to commercial farming based on foodgrain crops.

To study the micro level sequential progress analysis of a farmer of green revolution region and to enquire their challenges along with stumbling blocks in the given regional geographical and political system, a farmer's family was identified in north Delhi village Mukhmelpur. This village is located between river Yamuna and G.T.

Road in a flood prone region. The village Mukhmelpur is located in Khadar region of river Yamuna in north Delhi under Alipur Block Development Office. It is almost two km. east of G.T. road connected by single lane metalled road with a population of around four thousand persons with the educational facility of senior secondary co-education school, public sector bank, post officer and three anganwadi's in the village. The habitation of village is inhabited by heterogeneous castes in segregated Ghetto's like continuous settlement.

*The major castes of village Mukhmelpur (Delhi) and their traditional occupations for livelihood are as follows:*

1. Jats - Agricultural land owners - Farmers and rearing livestock (cow's and buffalo's) for milk and animate power.
2. Jatavs - Traditionally cattle leather processor's - cobblers and farm labourers. Occupation not in practice after mechanisation in farm sector.
3. Julaha - Weavers of cotton textile - Handloom weavers and agricultural farm labourers. Traditional occupation is extinct now.
4. Balmiki - Cleaning & maintaining cow dung and farm support workers - Rearing pigs, sheep, goat and hen.
5. Jogi - Allied activities as collecting milk for marketing and tailor etc. (traditionally beggar, now extinct).
6. Naii - Barber, Hair cutting jobs, marriage and other ceremony organisers, messengers and helping in household activities of farmland owners.
7. Lohaar - Black-smith and farm implements manufacturing and repairing.
8. Kumhaar - Pottery, Earthen and material transport, rearing donkey, mules and horses for transporting the goods.
9. Fakeer - Muslims converted Hindus, again followers of Islam. (Cross-caste occupation and they are landless).
10. Brahmins - Religious activities simultaneously with farming (now both the occupations are extinct).
11. Baniyas- Shopkeepers and traders.

Geographically, village Mukhmelpur is located in flood-plains of river Yamuna with the remnants of series of oxbow lakes formed after eastward shifting of the course of river. The groundwater table is rich with higher recharge as the subsoil is coarser sandy with high porosity. To protect Delhi city from the flood problem, a canal was constructed for shifting the surplus water of river Yamuna to vacant low-lying areas of north Delhi during colonial period. This canal passes through the farmlands of village Mukhmelpur from three sides and makes the village vulnerable to flood during rainy season.

Further, villagers through Kar-Sewa (Voluntary labour) constructed a 3 Km. long embankment in 1960 from one side of canal to other to protect the habitation and surrounding farmlands from regular floods. Therefore, the economy of the villagers was dependent mainly on rabi crop whereas Kharif crops are regularly destroyed by Yamuna flood. During 1978 (3<sup>rd</sup> Sept. 1978) flood of Delhi when 7 Lac cusec water was released from Tajewala headwork's in upper course of river Yamuna, considering this canal as genesis of flood problem in the region, it was observed by then Janata Party Govt. at centre and Delhi that the source of this canal from river Yamuna should be closed and parallel to river Yamuna and right margin dam on levee should be constructed from Wazirabad to Palla in Northern course of river. Further, source of canal was closed and a parallel dam was constructed along Yamuna to protect Delhi city from its flood. Since, the control of flood in north Delhi, the agricultural intensification has increased and non-farming activities also started in the region.

There is great range of micro level soil types, groundwater availability and presence of organic material (humus) in soil of the village as landforms evolved on sand bars, levee's, oxbow lakes, bluffs and low lying flood plains. On the basis of above mentioned micro level regional variations farmers coined the names of different sub-regions (farmland area) of village on the basis of varying crop-carrying capacity of soil are as follows:

- a. Khadar - Region which accumulates a lamina of fine clay during flood, known for good for cropping and located closer to river Yamuna.
- b. Dehar - Clay loamy humic soil region with ideal drainage. Most ideal for cropping and mainly green fodder crop. Located closer to village habitation in low lying plain region.
- c. Tibba - Elevated region, sandy coarser soil with poor drainage. Located on erstwhile sand mounds of river Yamuna.
- d. Bhudda - Poor and sandy-loam soil region with high calcium content. Located on elevated sand dunes of flood plain.

- e. Kundia - Low lying region with salty composition of silty soil. Good for rabi crop and located far from habitation near G T Road.
- f. Jolla - Calcium carbonate rich sandy soil region with poor drainage. Known for dryland farming encircled by pasturelands of village.

For micro level enumeration of identified farmers in village Mukhmelpur, Delhi who belongs to Jat community and owned little less than a hundred bigha's of cultivable land before green revolution. Even after consolidation process of the village, the farmers cultivated land spread at five different parts of the village upto the distance of two km. from habitation.

#### Size of cultivable land and distance from village habitation of the farmer's family:

S.No.	Geographical Location and source of irrigation.	Size of Cultivable land	Distance village km.
1.	Khadar- Persian wheel (Rahat),Flood prone/rainfed	15 Bigha	2.2 km.
2.	Jolla - dryland/Rainfed and prone to crop failure.	5 Bigha	1.3 Km.
3.	Dehar - Persian-Rahat	5 Bigha	0.4 Km.
4.	Seliawala - Persian-Rahat	15 Bigha	0.9 Km.
5.	Kundia- Dryland farming	45 Bigha	1.8 Km.
	TOTAL	85 Bigha.	

The inhabitants of village Mukhmelpur occupied two revenue villages. It is presumed that the residents of village Garhi Khusro relocated to village Mukhmelpur due to the regular flood hazards of river Yamuna. Therefore, the consolidation of both the revenue villages was performed separately which resulted into more than three different locations of the cultivated farm land of all the farmers. Because of the merger of two different revenue villages, the geographical extent of village Mukhmelpur is also comparatively larger than other adjacent villages. The farmer under enumeration owns the extreme east of village revenue area extent at Khadar farmland (Near Yamuna River Garhi-Khusro revenue village) and at extreme west low lying-Kundia (Near G.T. Road) farmland locations which are almost 4 Km. far from each other. Due to the distant locations of farm land from village habitation, the farmers have to face more challenges in building the desired infrastructure as irrigational network, accessibility, harvesting the crops, transporting the farm products, providing security to vulnerable crops and developing electricity network and tubewells etc.

The farmer (Ramnath and his father Solhu) was considered as an enterprising and risk taking who had purchased a tractor (Messey-Fergusson) the first lot of tractors imported from USA in 1950 of Rs. 6000 = by taking loan from a private money lender of adjacent village. Since the farmer's farmlands were located at farthest locations from villages habitation and adjacent to neighbouring villages, so, he was more mobile, interactive and exposed to more number of farmers which helped him to become more entrepreneurial farmer.

### **SOCIAL FABRIC OF FARMER'S FAMILY AND VILLAGE LIFE:**

During 1960s, apart from farming the farmers family was also rearing more than 100 live-stocks mainly cows-Hariana breed for milk as source of calorie, oxen;s (Nagori breed), not the bulls, as animate power for ploughing the field, running the persian-wheel rahat for irrigation and cow dung as bio-manure to maintain the soil fertility with cow dung cakes as main source of fuel for cooking the food. Apart from cow and bull, buffalo (Murra-breed) also reared as its milk in more calorific than cow. A camel was also kept by farmer, mainly for irrigating the fields from Persian rahat as camel hardly require any person to follow while working or rotating the Persian wheel of rahat for rotating the baskets in well for water. The female folks in the family were responsible for rearing, feeding and milching the livestock and they finds acute burden for indoor and outdoor laborious activities and longer working hours.

Socially farmer's family was highly rudimentary-traditional and knitted with Jajmani system of barter by exchanging the annual services by foodgrains and fodder for cattles. Though, different service providing castes were linked closely for inter-dependence. But untouchability was prevalent only with the non-vegetarian castes as sweepers (Balmiki) and cobblers (Jatav). Farmer's family was rigorous vegetarian and following Arya-Samaj sect of Hinduism. Though, females were more religious still they hardly go to temples for stone worship, like Brahmins and Traders (Baniya). All the farmers have an independent totem (localized God) which is located in the farmlands of each family. Among Jats joint family is considered as important asset which determine the social status of the family. Only arrange marriages are solemnized within Jat family (caste endogamous) but gotras (sub-groups equitable) exogamous and distantly located from their villages of same gotra.

Among Jats, marriages require the inevitably avoiding the gotras of bride's family, bride's mother's family and even bride's grand-mother's family with the same nomenclatures of groom's family to surpass the gotra endogamy and its side effects. All the gotra's of jats are considered at par with social hierarchy. With the following example, the possibility of marriage can be simplified.

Gotra's of Bride	Gotra's of Groom
1. Family - : Rana (Jatrana)	Dagar
2. Maternal- : Solanki	Dahiya
3. Grand-Maternal - : Tushir	Malik

(As none of the gotra is overlapping, therefore this marriage may get solemnized).

In the above case none of the gotra (Jat) coincide with each other, so this marriage may be solemnized with social recognition. This socially accepted and prevalent water tight instrumentation of marriage strengthened the brotherhood among the Jats. Almost all the gotra's are related and linked with each other which developed a sense of solidarity to each other. So, is the case of the one village habitation where all the Jat farmers generally belongs to same gotra are always supportive to each other in odd and adverse socio-economic conditions. Being the land-owning caste, the Jats are also considered as the social-managers as they are addressing the unresolved disputes of the society of all castes and social strata and control the agro based economy of the region.

In the farmer's family, the gender based division of labour was religiously followed. Females were assigned all indoor works while males were performing the outdoor (farm-fields) assignments. Even the children are trained in same fashion. The mechanisation in farm sector brought significant change in caste and occupational structure of family and society. Before the diffusion of green- revolution (mechanisation in farmer sector) following were the main assignments of women folks in joint family of the Jat farmers in the village:

1. Kitchen related cooking and arranging the wood and dung cakes for its fuel requirement.
2. Preparation of fodder (green & dry both) for all domesticated livestock.
3. Weaving the thread on charkha and sewing the attire of females and children.
4. Taking care of the children and supplying the food and fodder in the farmland for all the workers irrespective of their castes.
5. Milching the cows & buffaloes and processing the milk for different by-products by churning it.
6. Running the hand grain mill and obtaining the wheat and gram mixed flour on daily basis.
7. Cutting and carrying the green fodder as barseem or Jowar from the fields and feeding it to cattles every day.
8. Cleaning the cattle dung and bathing the buffaloes on daily basis.
9. Cleaning the house hold and cloths of all members of family.

10. Supporting the farm labour works particularly during harvesting season.

### **Pre-conditions of Green Revolution as Start-up:**

The close proximity of Alipur Block Development Office and innovative aptitude of the farmer Solhu in 1950 who was owning and cultivating almost 200 bigha of farmland at more than five different locations. With the help of animate power of bulls, the farmer was unable to use the entire farmland intensively. At one of the locations of farmer's farmlands at Jolla-micro-level localized region with high salinity in soil, where farmers was owning and cultivating more than 35 bigha of land without assured mode of irrigation. This patch of farmland at Jolla with poor fertility of soil, dryland farming and its location at the distance of more than one km. from village habitation was not much remunerative to farmer. Subsequently, in 1930's farmers planted the trees of desi-keekar (acacia-indicus or acacia nilotica) in his Jolla land for the commercial use of bark of acacia for leather processing (Tanin) industry in Delhi City. The villagers of Jatav caste used to extract the bark from the trees and supplied to leather industry for more than a decade.

Over the time with the increased human and animate labour capacity of family in 1949 the farmer cleared the acacia tree's from his field for crop cultivation. But the left -out deep roots of the trees were turn out to be stumbling blocks in crop cultivation. Manually, it was very difficult to extract roots of thousands of trees from the farmland. Considering the situation of farmer to make the farmland cultivable, an innovative social reformer of village Ch. Heera Singh, advised and supported the farmer to purchase a tractor for extracting roots of trees from farmland.

### **MAGIC OF TRACTOR AND LIMITATIONS OF ITS DIFFUSION:**

Provided the opportunity the farmer purchased the Messey Ferguessan Tractor in 1950 of Rs. 6000 by obtaining private loan from a money lender of nearby village. In first two years, tractor brought significant increase in net sown area and intensification of farming of 260 bigha of farmland and wheat production increased 300 Mann. (1 Mann is equal to 40 kg.) to 500 mann from 1950 to 1952. Tractor levelled the undulated topography and brought the distant and barren farmlands under regular crops. This magical machine (Tractor) became source of interest for large number of farmers of Alipur block as it was the first tractor in entire block. Several farmers get inspired from the outcomes of tractor and every day it was the source of attraction for the visiting farmers of nearby villagers. It increased the farm-product, net sown area, gross sown area and intensity of farmlands in initial years. Since, it was the introduction of technology at incipient stage where only machine was introduced in rural area without repairing workshops, spare parts fuel sumps and trained mechanics. Subsequently, after some time the



tractor required service and repairs which was not available in proximity. Spare parts are ordered first and supplied from USA which takes 6 to 7 months. Even diesel pumps were not available and farmer used to go to Red Fort, Delhi (30 km. distance) on bullock cart with a 200 Ltr. empty cylinder to fetch diesel once in two to three months. In the absence of mechanics and spare parts of tractor, it developed irreparable snags and could not be used. After six to seven years in 1957, farmer's family forced to sell out the tractor equal to the purchase cost of 2 bullocks and again purchased a pair of nagori breed bulls. Rather the farmer took a pledge that he will not allow any mechanised item working on a ball bearing on his farmlands. "*Bearing (ball bearing) kee cheez ko ghar mein nahi aaney dunga*".

**Innovative and Humanistic farmer :  
Using oxen not the bulls for ploughing in the field.**

The farmer under enumeration was Ch. Srichand (Solhu) and born in 1885, in 1902 he started ploughing the field by using the oxen as animate power. As vast pastureland was available in the village, the farmer's family was rearing around a hundred cattle, mainly cows, oxen, camel and buffaloes. To make the bull usable in farmland related workforce as ploughing and harvesting the crop, the oxen calf passes through three stages.

1. Castration : Where testacles are either removed or destroyed to neutralize the sexual lust and power of oxen.
2. Nose string : By piercing the nostrils (One of the most sensitive body part of ox) and tying with rope to control the animate power.
3. Hoof protection : To fix the metal sheet on the hooves of bovine with nails to protect it.

As all the above processes were highly painful, inhuman and dangerous for the life of oxen. Therefore considering the life threatening situation of ox, the farmer never allow there ox's for castration, nose string and hoof protection. Farmer considered that castration and nose string processes are inhuman and extremely horrifying, therefore even after immense power of animal, it may be used without controlling measures.

The farmer Solhu always make their oxen use without castration and nose string because he never allowed painful treatment of bovines. Though it was a herculean task to use the bovine force into ploughing without rigorous control measures.

It was very unique experiment and farmer executed it quite meticulously by using up to 4 pairs of the oxen-animate power simultaneously in farmland for ploughing etc. . It was consider as miracle as non of the farmer in the region were able to use the bovines without castration and nose string.

Almost after a decade with tractor, the farmer's family was fed up with its regular break- down and non-availability of its spare parts. Gradually, it was junked due to its idle and non-functional condition. On the other hand, the size of joint family of three sons of farmers become bigger and demand from farmlands have increased. But, tractor failed to satisfy the increased demand of food-grains and finally due to growing unrest in family, the tractor was sold in lieu of a pair of bulls.

Subsequently, all the three sons of the farmer also got separated and the total 178 bigha farmlands at six different locations divided into three parts 60, 60 and 58 bigha each after a tough exercise in 1957. The division of farmers joint family influence the allied supporting castes greatly as the jajmani based dependent families are also divided to share their respective work. Simultaneously, large number of livestock i.e. bovines were also sold out on auction publicly. All the three separated brothers further generated the desired farmland related infrastructure individually as bullocks, cart, ploughs, wells, irrigational channels etc.

The eldest son of farmer named as Ramnath, who is under enumeration, got 58 bigha of farmland at four different locations in two revenue villages, including two of the farthest and opposite locations, from the village habitation. Back with the animate (bullocks) power after junked out the non-usable tractor, farmer Ramnath further purchased 26 bigha of farmlands at three different locations.

Following table shows the progression chart of farmer with size of farmlands and mode of irrigation during 1960:

S.No.	Location	Size of farmland	Year	Mode of irrigation
1.	Khadar	15 Bigha	1962	Persian wheel rahat of adjacent farmer of different village.
2.	Jolla	6 Bigha	1962	Unirrigated- Rainfed.
3.	Selaiwala	15 Bigha	1962	Persian wheel Rahat
4.	Kundia	22 Bigha	1962	Dryland-Rainfed
Total = 58 Bigha				
5.	Khadar	11 Bigha	1972	Dryland/Flood prone
6.	Jolla	6 Bigha	1972	Dryland
7.	Selaiwala	15 Bigha	1972	Persian wheel- Rahat
8.	Kundia	43 Bigha	1972	Tubewell - 4" bore
9.	Dehar (Gora)	5 Bigha	1972	Tubewell - 4" bore

10.	Phirni (Gora)	1 Bigha	1972	Tubewell - 4" bore
		Total = 81 Bigha		
11.	Khadar	11 Bigha	1982	Dryland farming.
12.	Jolla	6 Bigha	1982	Dryland farming.
13.	Kadipur	5 Bigha	1982	Rented Tubewell
14.	Selaiwala	15 Bigha	1982	Tubewell Rental basis.
15.	Kundia	55 Bigha	1982	Tubewell - Electrified
16.	Dehar (Gora)	5 Bigha	1982	Tubewell - Electrified
17.	Phirni (Gora)	1 Bigha	1982	Tubewell - Electrified
		Total= 98 Bigha		

### **ROLE OF EDUCATION FOR CHANGING THE FARMING METHODOLOGY:**

The farmer under enumeration is Ramnath who was the eldest son of Srichand (Solhu). Ramnath had five sons to whom he wanted to involve in farming. But, the mother of five brothers preferred to teach them even with limited educational facilities in the region immediately after the independence of India. The eldest son of Ramnath joined Indian Army's Jat regiment after 1962 Indo- China War and became economic safety-valve of the flood and drought prone animate based farming of the family. The second son became a school teacher in primary school who got the wide exposure of farm technology. The third son became farmer and joined his father in farmland cultivation.

The educational advantage, wider exposure due to outdoor job conditions and economic assurance due to govt. job of both the elder brothers ultimately resulted in following improvement in agriculture.

1. Purchased -15 Bigha farmland in 1968.
2. Installed electrified tubewell at Kundia farmland 1969.
3. Purchased- 6 Bigha farmland at Kundia (Jogi) in 1970.
4. Purchased -5 Bigha farmland at Dehar-(Gora)-1965.
5. Purchased -1 Bigha Phirni (Gora) land-1968.
6. Purchased a DT-14 Tractor (Russian) in 1969.

7. Purchased first generation of thrasher/seperator for wheat crop harvesting in 1971.
8. Increased the Gross sown Area by taking leased farmland and raising atleast two crops in a year from the same field in 1972.
9. Introduced HYV seed of wheat as Sonalika, Sarbati, Sonera, HD-1553 and C-308 etc. in 191969 onward.
10. Introduced fertilizer, Nitrogenous DAP & NPK in 1971 onward.
11. Sold bulls and cart and all animate power driven agricultural implements and completely shifted on tractor in 1974.
12. Further, purchased the advanced technology Escort-335 tractor in 1974.
13. The total wheat production of farmer's family increased from 350 Mann in 1965 to 800 Mann in 1975 and over 1000 mann in 1981.
14. Working hours of females of family in farmlands reduced drastically and later shifted to rearing the domesticated livestock for milk only after the purchase of tractor in 1971.

### **FARMLAND INTENSIFICATION AND COMMERCIALIZATION**

The introduction of mechanisation in crop cultivation mainly by using the tractor and installing the electrified tubewells revolutionized the cropping methodology of farmer. It decreased the human labour input in farming which ultimately increased the education of the young children of family. Application of tractor initially levelled all the undulated and irregular farmlands to make it feasible to grow atleast two foodgrain crops in a year from same field. Simultaneously, farmer's family started growing seasonal vegetables such as tomato, reddish, ladyfinger, spinach, cauliflower, gourd and marigold flowers etc. which economically supported the family round the year. Whereas two foodgrain crops (wheat in rabi season and Rice/ Bajra in kharif rainy season) were giving economic return twice in a year. The vegetable cultivation in small farmlands ensured monetary flow in family round the year.

The use of HYV seeds of wheat and fertilizers increased the wheat (rabi crop) production of farmers family in 1971 onwards where more than 80% of wheat was supplied to market which changed the nature of farming from subsistence to commercial. Almost after a decade of commercialization of rabi-wheat crop and the village was protected from regular flood of river Yamuna during Kharif crop by constructing a right marginal dam along Yamuna where kharif rice crop was also commercialized.

The development of assured irrigational infrastructure such as tubewells provided the opportunity to farmers to grow rice crop during kharif-rainy season for commercial purpose. Conventionally, rice was not among the list of diversified Kharif Crops. Only rainfed crop were grown before 1978 flood in the village, such as Jowar as green and dry fodder for cattle, Bajra as foodgrain and dry fodder, maize as green fodder and foodgrain, millets as cluster bean (Guar) etc. for animal fodder.

Growing the two foodgrain crops in a year for commercial purpose alongwith vegetables during Zaid season strengthened the economic condition of farmer. In 1982, farmer approached to Pusa, Indian Agriculture Research Institute (IARI) and signed an agreement with National Seed Corporation (NSC) to obtain the foundation seed of wheat and supply the certified seed to NSC on much higher rates than minimum support price (MSP). The farmer supplied the certified seed direct to NSC almost for a decade. Subsequently, due to over withdrawal of groundwater mainly for rice depleted the groundwater drastically from 20ft to 100ft. The intensification of farming, overdoses of fertilizers, pesticides, weedicides, and insecticides etc. alongwith higher input cost reduced the carrying capacity of soil. Gradually, the law of diminishing return applied and farming was left with low remuneration. The youth of family who got education started deviating from farming as source of livelihood.

#### **OCCUPATIONAL DEVIATION OF FAMILY FROM AGRICULTURE:**

The rural-urban fringe location of the village increased the pressure on farmlands for series of non-farming activities borne by exploding urbanisation of Delhi city. In 1993, the entire farmland (57 Bigha) of Kundia micro-region of village was acquired by Delhi government for the construction of STP-Sewerage Treatment Plant of liquid waste of Bawana -Narela industrial region before draining it to river Yamuna. Unfortunately, for the last 25 years that land is lying idle and unused. Government of Delhi failed to construct the desired STP to check the Yamuna pollution so far. After losing the largest chunk of farmland (kundia) to Delhi Govt. the farmer's family lost the interest in farm product based economy and youth of the family preferred non-farming based economic activities for livelihood.

The second large chunk of farmland of 14 Bigha at Khadar micro region of village lost its fertility after the construction of dam on river Yamuna and disappearance of regular clayey-loamy layer of soil during flood. Further, in village revenue record, that 14 bigha Khadar farmlands were not connected by common pathways for accessibility to field. Over the time, with increasing economic significance of agricultural land, other farmers refused to provide approachable access to farmer to cultivate their farmlands. The landlocked situation, losing soil fertility and distant location from village habitation makes the farmland as non- remunerative asset. Subsequently

the given conditions forced the farmer to sell out that chunk of farmland along with other farmers to suitcase urbanite businessmen.

The loss of two bigger chunks of farmlands and divisions of property among the five sons of farmer, left the farmers divided family with a little cultivable land and it was not sufficient to meet the need of the family. The farmer had five sons and a daughter, but entire immovable residential and agricultural farmlands were divided among sons only and culturally daughter's were not the share-holder. Out of the five sons of farmer, four of them were engaged in government jobs of different hierarchy. With the divided farming, the livestock rearing also become a difficult task. The non- availability of pasture land, green fodder, space for cattle yard, health hazards due to fertilizer borne green fodder and procreation related problem forced to leave the livestock rearing as occupation and supporting economic activity while mushrooming dairy's by outsiders substituted the need of milk of family.

### **STAGE OF DIMINISHING RETURN:**

During early 1980s, the gross sown area of farmer's farmlands increased rapidly and non of the piece of farmland were lying fallow in any of the three cropping seasons. It became possible due to introduction of rice as commercial foodgrain crop during kharif season and closer proximity of vegetable market in Delhi city. Apart from raising the wheat crop during rabi season, the vegetables during zaid season and rice during kharif season crop from same field resulted into maximum intensification of farming. Round the year the farmlands are cropped with intensive use of land and non of the farmland left fallow to regain the fertility. Such intensive land-use of farmlands deteriorated the fertility of soil which was compensated by series of inputs as :

1. Pumping regular doses of urea, NPK and complex chemical fertilizers.
2. Spraying bio-manures in the soil to increase the bacterial action.
3. Raising crops for tillage as green manure for increased bacterial action in soil.
4. Adding the compost of farm waste to the soil.
5. Giving gypsum along with the irrigation.
6. Tillage and harrowing the soil repeatedly to increase the nitrogen fixation.
7. Rotating the leguminous crops as pulses which through nitrification maintain the nitrogen in soil.

Over the time with increased farm input in comparison to cost of farm product the law of diminishing return applied in 1985-90. It was the time of maximum return of profit from farmlands. Simultaneously, the urban expansion starting approaching the farmlands where the largest chunk of farmland of farmers family was acquired

by government for non farming objectives which leads to occupational deviation from farming for economic livelihood.

The following table shows the increasing trends of net sown area under wheat its production and productivity of the farmer's family:

S. N O.	YEAR UNDER CONSIDERATION	NET SOWN AREA UNDER WHEAT IN BIGHA	PRODUCTION IN QUINTAL	PRODUCTIVITY (Qtl./Bigha)	IMPACT FACTOR : INPUTS
1	1950	125	120	0.96	Animate farming
2	1952	150	200	1.33	Introduced tractor.
3	1958	55	80	1.45	Back to animate farming.
4	1964	65	115	1.76	Animate and increased family labour
5	1969	85	170	2.00	Electrified tube well.
6	1971	105	230	2.19	Tractor+Tube well-2+HYV Seeds.
7	1975	125	370	2.96	Tractor+Tube wells+HYV Seeds+Thrasher+Fertilizers.
8	1980	120	435	3.62	Tractor+Tubewells+Advanced Thrasher+Fertilizers+Pesticides+NSC Foundation Seeds.
9	1992	90	360	4.00	Increased financial and technological inputs+NSA reduced+Youth deviation from farming.

The intensification of farming increased the pressure on soil and water resources and depleted the quality and quantity which ultimately diminishes the economic return. Resulting it by 1990, the farmer's family deviated from growing the vegetables as it was labour intensive process of farming. Further, the younger generation of family got engaged themselves in alternative economic activities because of access of higher education. The

conventional farm labour force of allied landless castes in village also got alternate employment due to education and reservation policy and deviated from low wages and seasonal farm employment. Subsequently from 2000 onward, apart from growing vegetables farmer's family also started deviating from the cultivation of rice crop because of many reasons such as :

1. Rapid decline in ground-water table due to faster withdrawal than recharge by tubewells as rice is an water intensive crop from about 40 ft. depth in 1980 to 200+ ft. in 2000.
2. Quality of soil deteriorated due to intensive cropping of foodgrains which consumes more nitrogen from nitrogen deficient soil in combination with over-doses of chemical fertilizers and other chemicals as weedicides etc.
3. Increased maintenance cost of electro-mechanical infrastructure at the farmland for irrigation.
4. Lack of HYV seeds of rice (like wheat) which leads to constant farm output while investment cost keep increasing.
5. Withdrawal of seasonal & cheap farm labour which was regularly coming from Bihar and other parts of eastern India due to MG NAREGA. The same labour force also shifted to industrial regions as Faridabad and Ludhiana etc. due to higher and consistent wages.
6. Rice require manual harvesting which is labour intensive and leads to higher investment and lesser profit to the farmer. While the wheat crop is harvested by combined-harvester and require no extra labour force.
7. The rice crop particularly its HYV seeds are prone to weeds, pests, insects and plant diseases as this is the crop of hot and humid season which decreased the crop production and profit margin both.
8. Rice as a staple foodgrain crop recorded marginal increase in its minimum support/procurement price in the market while investment cost keep increased manifold which applied the law of diminishing of farm product.

With the improvement of farm technology, market facility and the availability of financial support the nature of crop combinations also changed by farmer's family. It shifted from sedentary farming in 1950 to subsistence farming in 1960 and then intensive subsistence farming in 1970 onward. Further, farmer shifted to mixed farming to grow the food grain with vegetable crops in 1980. From 1990 onward the nature of farming become commercial foodgrain where almost entire farm product supplied to market with maximum input of machines. Over the time, livestock rearing for milk remained as an important occupation of family. As entire family is vegetarian therefore milk remained the most important source of calorie. But from 1990 onward the native breed of cow was replaced by exotic breeds as jersey and friesian for their more milk production in the family. The number of buffalo's also decreased to nil by 2010 as requires more care and investment. It was observed that



livestock population in family become getting more prone to various seasonal and non-seasonal diseases may be because of stall feeding and green fodder raised by the inputs of fertilizers and other chemicals.

The crop combinations have been reduced gradually while farming methodology and nature of input changed from 8 to 10 crops in 1950 to only 3 crops in 2010. The changing nature of crop combination of family if given below:

1. **1950** : Wheat, Gram, mix of wheat and gram called gochani, Barley, Jowar as fodder for cattle, Cluster bean (guar), Sugarcane, Bajra (Pearl Millet), Peas, Mustard, Egyptian clover (Berseem). Stage of diversified cropping.
2. **1960** : Wheat, Gram, Bajra, Barley, Jowar, Maize, Mustard, Oat, Berseem.
3. **1970** : Wheat, Barley, Gram, Bajra, Tomato, Mustard, Peas, Moong bean ( green gram)
4. **1980** : Wheat, Barley, Jowar, Rice, Bajra, Sugarcane, Marigold, Tuberose, Tomato, Reddish, Lady Finger, Chillies, Brinjal, Cluster bean and many other green seasonal vegetables. Stage of maximum crop diversity.
5. **1990** : Wheat, Rice, Jowar, Mustard, Onion, Berseem.
6. **2000** : Wheat, Rice, Jowar, Mustard.
7. **2010** : Wheat, Rice, Jowar. Stage of complete monoculture.

## URBAN EXPLOSION AND GRABBING THE ECONOMIC OPPORTUNITY

During early 1980's the farmer reached on the culmination of farm production by using machines, HYV seeds, chemical fertilizers and pesticides assured irrigation and growing wheat and rice foodgrain crops intensively along with seasonal vegetables. One of the largest chunk of farmlands of farmer was located very close to G.T. Road. In the close proximity of G.T. Road, the farmlands were in high demand for various non-farming activities by the suitcase farmers. Many farmers in the neighbourhood sold their farmlands for various non farming economic activities to urbanite outsiders.

The combination of farmers good economic condition due to mass production from farmlands and higher educational status makes them aware of land- revenue related intricacies and attracted them to shift alternate occupation of real- estate transactions. Simultaneously, the out flux of Hindus from Punjab due to its internal insecurity and Punjabi Hindu out-migrants preferred to invest huge money for the purchase of farmlands along G.T. Road. The farmer's family members won the confidence of desperate Punjabi- Hindu- immigrant investors and started earning unexpected income.

Once the farmer's family members started earning more money from real estate transaction of farmland which was more remunerative than farming. It leads to deviate the family's main occupation from farming to property dealing. Gradually considering the scope of large demand of earthen bricks in Delhi and complete ban of brick-kiln in Delhi jurisdiction by Supreme Court of India due to environmental concern, the farmer's family established a brick- kiln in Haryana bordering the Delhi in 1989.

The combination of real estate and brick- kiln as occupation completely deviated the source of livelihood of family from farming to services and manufacturing sector. The exponentially increasing demand of warehouses/godowns in outskirts of Delhi where DDA failed to provide space for them. The farmer's family members particularly youngsters started constructing godowns/warehouses for the urban traders. Over the time, the family have purchased agricultural land in different parts in Delhi and its periphery, not for farming but for future economic security and remunerative investment. Many warehouses are owned by family which are leased out for regular income where farmers family shifted from farming to non- farming activities as occupation.

Table shows the generational change and stages of development of family:

<b>Stages of Development with Generational Change</b>			
S.No.	Generational Hierarchy (Enumerated Farmer's family)	Time of effective decision making	Stages of Development in Farming
1.	Charan Rana Singh	(1850-1915 lifespan), 1870-1905.	Traditional Stage: Rudimentary farming with animate power.
2.	Srichand Rana (Solhu)	(1880-1952 Lifespan) 1905-1955.	Traditional to transitional Stages: subsistence farming from animate power to mechanised tractor.
3.	Ram Nath Rana	(1911-1996 Lifespan) 1951-1973	Transitional to traditional to Transitional Stage: Intensive subsistence farming for animate power to tractor machine and electrified tubewells.

4.	Samey Singh Rana	(1942 onward continue)  1974-1997 & 2010-till date...	Take off Stage: Intensive foodgrain farming for commercial purpose alongwith allied commercial activities as transport and real estate activities.
5.	Ombir Singh Rana	(1966 onward continue) 1997-2010 and shifted to non farming activities.	Drive to stage of maturity : Commercial farming by leasing out widely fragmented farmlands. Economic dependency completely shifted on trade, commerce and manufacturing as real estate, brick-kiln and warehouse construction and leasing as occupation.

### UNIQUITIES OF FAMILY AND ITS ADVANTAGES

Family of the farmer always bestowed with the privilege of enterprising farming. Family purchased the tractor in 1950, which was the first and pioneering attempt in entire rural Delhi. It also converted the part of farmlands first time in village into agro-forestry by raising the acacia indicus (desi keekar/babool) tree for commercial supply of its byproducts as tannin in leather processing industry. The enterprising attitude of farmer's family continued when they installed the first electrified tubewell in remotest part of village and intensified the cropping. The mechanised thrasher for harvesting the wheat crop was introduced by the farmer in the village. The family was among those a few farmers who became able to increase their farmlands by purchasing it. The family contacted the IARI, Pusa, Delhi and started cultivating the foundation seeds and supply them as certified seed of wheat to NSC, national seed corporation. He availability of tractor for transportation facility, the family started cultivating the green seasonal vegetables for commercial purpose.