

FIELD RESEARCH REPORT ON SPATE IRRIGATED CROPS IN SINDH, BALOCHISTAN AND THE PUNJAB

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Background of the Project

The hill torrent spate irrigation is unique in nature and perhaps one of the oldest surface irrigation systems that provided economic basis for some of the early civilizations in the world. It involves the diversion of flashy spate floods running off mountainous catchments to irrigate arable land. In Pakistan, 14 distinguishable hill-torrent-spate areas in the four provinces with a total runoff potential of about 1.5 Mha have been recognized.

The land coverage of spate irrigation systems has also been estimated and compiled by Food and Agriculture Organization which shows about 1.4 million hectares of land under spate irrigation in Pakistan (FAO 1999). In fact, the actual area of spate irrigation might be more than estimated in FAO statistics. In one of the feasibility study for flood management of hill torrents, NESPAK (1998) has identified major hill-torrent regions in the entire country. The regions include Balochistan plateau, Kirthar range of Sindh, and Suleiman range of NWFP and Punjab provinces.

The entire spate irrigated area provides livelihood for farmers in the region, probably struck by the most widespread poverty cluster in the country. However, currently the major part of the hill-torrent flows is wasted due to insufficient management. If this water were properly harnessed, managed and utilized, it would not only add a momentous volume into to dwindling water resources of the country, but a significant size of arable land could be cultivated as well.

Management & Development Foundation (MDF) in collaboration with different national and international organizations has been conducting assessment on farmers cropping patterns and the income generation through diversified crops cultivated and the modern trends of farming employed along with efficient water conservation techniques to gain maximum outputs from the agricultural fields. MDF has been mobilizing the farmers under its Farmers Empowerment Initiative in which the farmers are provided with trainings along with some credit amount to harvest the crops keeping in view the utilization of the learnings of trainings and mobilization. MDF is currently implementing the project on Farmers Organizations in Khairpur district and it has been organizing the farmers and providing them trainings on agricultural extension, water management, livestock management, social mobilization, advocacy mechanism and kitchen gardening. These farmers are also being linked with World Bank's and Government of Sindh projects i.e. SIAPEP and SAGP.

Methodology

Understanding the Assignment

As per the assignment, the main objective of the consultancy is to carry out an assessment of business opportunities for market crops from spate irrigated areas in DG Khan (Vehoa, Sangar), Balochistan (Nari) and Sindh (Kohistan). MDF has conducted the qualitative study in the above mentioned areas and the consultations have been held with farmers, processors, business men, traders and government staff/agricultural experts. The focus of the study has been on collecting the information on current demands, future demands, marketing influenced by better value chains (contracts, processing) and better water management & farming practices. The prime aim of the study is to identify opportunities for business development that will be triggered by the improvement of the spate system.

These business cases has been quantified and worked out under the Dutch SWF program. Here the efforts have been made in convincing case that the project will create sustainable businesses that will profit from the improvement and investment of the project – and that through their business will contribute to the long-term project impact. In case of the trade and processing of farm produce – giving a fair price – this is possible.

The crops focused for the study has been those largely reliant on spate irrigation:

- i. Oilseeds - mustards, sesame, rapeseed;
- ii. Sorghum for poultry; and
- iii. Guar.

In order to accomplish the assignment, MDF proposes the following strategies:

Sampling Strategy

The qualitative methodology has been employed by conducting Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) from DG Khan (Vehoa, Sangar), Balochistan (Nari) and Sindh (Kohistan). It is pertinent to mention that in each location 3 FGDs have been conducted with farmers practicing spate agriculture and depending on spate irrigation practices. The 5 KIIs have been conducted with the processors, business men, traders and government staff/ agricultural experts in each location.

S #	District & Province	FGDs	KIIs	Responsibility
1.	DG Khan (Punjab)	3	5	MDF's Key Experts and Coordination with Meta Meta for Feedback
2.	Jamshoro/Dadu (Sindh)	3	5	
3.	Nari (Baluchistan)	3	5	
Total		9	15	

Data Collection Methodology

MDF team has consulted with Spate Irrigation Network Foundation (SpNF) to seek the Checklist of FGDs and KIIs if it's made available, however, the Data Collection Tool for FGDs and KIIs have been developed and shared with SpNF for approval. In order to collect the data, the 4 Research Investigators along with Team Leader were proposed to accomplish the assignment:

District	Province	Research Investigators	Total Days	FGDs	KIIs
Jamshoro/Dadu	Sindh	4	3	3	5
DG Khan	Punjab	2	7	3	5
Nari	Balochistan	2	7	3	5
Total		20	40	9	15

It is anticipated that the qualified, competent and well versed Research Investigators have been deputed in Sindh for 3 days and Punjab & Balochistan provinces for 7 days, however, the collection of data have been completed in 15 working days. MDF has brought on board the potential Research Investigators who understood the importance of the survey and ensured the data quality.

Training of the Field Team

Prior to conduct the assignment, MDF proposed 2-day extensive training in Hyderabad for the research investigators on checklist of FGDs and KIIs to collect the data: one full day in the training hall and second day in spate irrigated communities in Jamshoro district to pre-test the questions as simulated data collection activity and develop implementation strategy for data collection and reporting mechanism. The SpNF team have also been coordinated via Skype to give their understanding and perceptions on the study and the information and suggestions have been incorporated in the study and the research team has followed the ethical considerations in the study.

Data Analysis and Quality Assurance

After collecting the data through FGDs and KIIs, the data analysis have been carried out. The quality assurance have been ensured throughout the data collection and maintenance process. This has allowed for on-going feedback and support throughout the data collection process. This approach also provided the possibility to monitor the data collection, both in terms of progress of work and of quality of the collected data throughout the process.

Findings

EXTRACT FROM THE FIELD SURVEY REGARDING SPATE CROPS IN PUNJAB, BALOCHISTAN AND SINDH PROVINCE.

3 Spheres of the Spate Crops were explored

(A) At Farmer Level

- (i) Production and cultivation practices, seeds ratio, type of soil, soil management, seeds availability, current market rates, local sale at farm gate, varieties grown, farmers level home consumption of various spate crops, remains and left over of the crops e.g. chuff, dry and green fodder local consumption and sale.
- (ii) Land Preparation and Land Management
- (iii) Water Source and Water Management
- (iv) Varieties Cultivated
- (v) Opportunities
- (vi) Additional Measures
- (vii) Storage
- (viii) Marketing
- (ix) Credits
- (x) General information

(B) At Trader and Grain Traders

The following Main Question were put in the Survey list

- (i) History of the Business
- (ii) Annual Procurement and Storage
- (iii) Forward Sale of different spate Crops
- (iv) Packing Material etc.
- (v) Payments to the Local Farmers

(C) Government Level Support to the Farmers

(D) Gap Analysis

The Major and Marketable Spate Crops Season Wise

Bear in mind that all crops are cultivated in spate irrigated systems by utilizing surface run off, direct rain fed land in the vicinity of spate area and spate structured water management techniques. The rain fall season is a monsoon wind that brings rains in entire spate areas of Pakistan from May-August every year. Occurrence of late summers rains is now becoming eminent even after August due to climate change or shift in the downpour trend which is extended till the end of Aug-September-November.

Last 3 years (2014-2017) received low rains in monsoon in Punjab, Sindh and Balochistan. However there was augmented affect in Balochistan during 2016. In Balochistan more land was irrigated than the size of actual size of the command in Kachi Balochistan. Probably due to not extra rains, but extended catchment area and improved water diversion structures.

Following are Major crops of summer season. Cultivated in summer months 15 Jun-15 August and harvested through November-December every year.

- 1 Sorghum
- 2 Mong Beans
- 3 Mooth Beans
- 4 Guar
- 5 Sesame seed

Winter Crops, cultivated from 1st week of Nov to 15 Dec every year and harvested in the first week of April to end of April.

- (1) Chickpeas
- (2) Wheat
- (3) Oil Seeds (Mustered 2 varieties e.g.(bitter and sweet)
- (4) Corianders

CHAPTER - I

Extract of each summer season crop from Cultivation to end use:

Sorghum

Sorghum is major crops in all 3 provinces of Pakistan. Due to moisture availability in summer months farmers have no choice (there is no alternative other than Sorghum to grow, that produce is used as green fodder for farmer's livestock which is the second largest source of income for the land owner and tenants in Balochistan. In Sindh and Punjab lands are owned and operated by owners themselves due to small land ownership. In Balochistan sorghum is more important for Kachi farmers where highland livestock herders migrates to the low lands in winter and they settle around the Kachi, Jhal Magsi and Sibi district and purchase the fodders for their animals and spend 3 months so they provide an opportunity for the local farmers to make money through grains as well as sale of the sorghum fodders and its remains and stubbles etc. Where in Punjab and Sindh no significant numbers of livestock herders visit in any seasons.

All in all DG Khan and Rajanpur in Punjab province and Kirther regions of Sindh province are comparatively small in size of command area of Kachi in Balochistan. So Kachi is largest single spate irrigation system in Pakistan.

Generally two varieties of Sorghum are cultivated in Punjab, Balochistan and Sindh. It is called with different names (*sufaid*) white and (Pale) yellow or (*Ratur*). In Balochistan it is called (sweet and Kangri). Sweet variety has water bearing characteristics in its stem and animal like its fodder where other (Kangri) plant is hollow inside and does not have water in stem and not liked much by the animal. When green both have equal fodder value. Similarly carry equal value of its grains.

It has tendency getting dry at immature level if there are no subsequent rains or supplementary irrigation due to land quality like in Vehoa and Sanghar river in Punjab lands comprises sticky clay that does not get dry quickly and do not allow the crop root to extract water. In other case it surface layer dries quickly need re-vetting to allow the plant to flourish its roots.

In Taunsa and Rajanpur area in Punjab lands quality is better (silt and clay) and in most case if land have received enough irrigation, the sorghum does not need subsequent irrigation and crop ripen successfully. In Balochistan Kachi area the sorghum does not need later irrigation or rains if the fields have captured enough during first irrigation. Success ratio is 80% and 20% goes failure and crop dries up before maturity. In such cases it used as animal fodder by the land owners and tenants.

In Taunsa Punjab the tendency of growing Sorghum is reduced due to low commercial value of its grains, and fodder sale in local area. So farmer grows it but with heavy heart having no other option to utilize the moisture captured in summer months. In this area majority of the farmer

are diverted to winter crops or keep the moisture for longer time to reach in into winter season crops that have more commercial value and returns.

Land Preparation: Majority of farmer 60% reported that they plough (dry) land 1 time in the month of May every year to get it prepared to absorb more water during floods for healthy crops.

Source of Irrigation Water:

In Punjab: Small to medium and large hill torrents in Rajanpur and DG Khan in Punjab emanates from western Koh-e-Suleiman and irrigates the lands.

In Balochistan: The province is out of Indus river irrigation system and entirely depends on the rains and spate irrigation particularly southern Balochistan. There are 17 distinct water basins which comprises thousands of catchments and serves for irrigation and drinking water needs of the Province.

In Sindh, small catchments in western Kirther regions are source of irrigation water in piedmont area of the hilly regions of province. Direct rain fed region of Thar is also prominent region for cultivation of dry land crops mainly (mooth, millet and guar).

Seeds Application Ratio: 20 kgs per acre (in all provinces)

Sale of fodder: Depends on different situations, sometimes farmer sold the standing crop, sometime after cutting of (panicles) the remains are sold. Rates are not standard, every one sell or buy looking at the local conditions and availability of the size of irrigation in one area. If the crop in the vicinity is in abundance the rate will be low and vice versa. Current rate are Rs: 2000/kanal (1/8th of an acre) in Punjab spate irrigated areas because the year was dry and demand is high in local livestock herders. Occasionally Afghan Nomads also buy for their animal that visit the area and stay through winter months.

In Rajanpur Punjab following rates are observed: 3 wanda are carried through 1 camel load amounting to Rs: 250-300 dry grass per 3 wanda. In addition the standing fodder after panicle harvesting is sold at Rs: 13000-15 per acre. Different Baloch tribes Gorchani, Umarani Lashari visit the areas and buy the fodder for their animals in Nov-Dec –Jan every year.

In DG Khan it depends on the size of land. Roughly the standing sorghum with panicles is sold from Rs: 80,000 to Rs: 250,000 per an average size of (*bund/ field*) 3-5 acres a kind of local trader who buys the sorghum crops.

In Balochistan, standing crops are sold to the livestock herders coming from high land. One field of 10 acres standing sorghum together with mixed mung and mooth are sold from Rs: 100,000 to 400,000. They purchase and possesses the entire crop and its remains. If land owner harvest the panicles and pulses, he sell the gross to small trader who carry it to Quetta and Jacobabad, Dera Murad and local livestock herders as well. The following rates are charged in

terms of vehicle loading from the crop areas: Rs: 8000 truck load, Rs: 7000 small truck load and Rs: 3000 tractor load.

In all spate irrigated areas farmer also stock the dry piles of sorghum fodder that is used to feed the domestic animals especially in the months of Jan-March every year.

Retailer Rates of sorghum fodder in Balochistan:

Chopped fodder (Toka) Rs: 35/5 kgs (Punjab and Balochistan).

Green Panicles Rs: 15/Kg

Sorghum grain: Rs: 30/kg Mooth Rs: 50/kg

In Punjab Chopped fodder Rs: 35/5 kgs

In Sindh some farmers informed that they sell 15kgs bundle of fodder at the cost of Rs: 50, however, the rates for the chopped Sorghum fodder is Rs:30-40/5 kgs and there are small retailers who own small machines to chop the fodder before they sell it.

SEEDS APPLICATION RATIO

Usually farmers keep the seeds of previous year to use as seed. If the dry spell is elongated, they sell the stored seeds being older and affected, they buy new seeds to grow.

In Rajanpur: Farmers keeps the Sorghum Panicles and clean them before cultivation. In other areas people keep seeds up to 1 year. Following is application rates: Sorghum, mung and guar are drilled not broadcasted:

Per acre seeds application: Sorghum 10kgs, Guar 10kgs, Mung 10 kgs, if mixed: Sorghum 5 Kgs, Mung 3 Kgs, and Mooth beans 2 kgs per Acre.

In Sindh: Farmer does not grow Moth beans in spate areas and Mung beans are grown at small scale. In Punjab no Mooth are cultivated and Mung are grown only for home consumption. The adjacent Chashma Right Bank Canal command area of Taunsa in DG Khan Punjab, farmers grows Mung beans.

Sesame seeds 2kgs/acre: it preferably grown where ground water is available as the corps needs supplementary irrigation. It is grown in Thana Bola Khan in Sindh and Jhal Magsi Balochistan where farmers having lands near Kirther range have open surface well that yield water after rains and gets dry if rains are disappeared for one year.

Home Consumption: Sorghum as staple food is not used anywhere in Pakistan. Farming communities in Rajanpur Punjab reported that they eat sorghum bread in winter months. They further informed that local households make pop-corn of sorghum mixed with molasses and convert it into small balls which are sold Rs: 5 per ball seasonally as local confectionary. They said that they also make pop corns during the month of (Moharam) when they don't lit the fire

on 10th Moharam and don't cook food so kids are fed at this day as well. In Balochistan and Sindh it is occasionally eaten by the people as a mood food or converted popcorn. Its bread is reported healthy food for patients who have digestion or stomach problems.

MARKETING AND SALE AT FARMER LEVEL

Farmer sells the sorghum grain to local traders and shop keepers who sell it to the Tehsil level Trader. In every village there are 20-50 small traders who buy from individual farmer and when they have truck load, they send it immediately to big trader in Tehsil and District level. Then it is sent to larger market in big cities. Reportedly Sorghum's largest market is reported in Karachi and Hyderabad for Sindh farmers. For the Punjab and Balochistan, Faisalabad and Lahore are reported Largest Markets. This is probably that the sorghum seeds are further used throughout the country to grow green fodder from its seeds.

Usually farmers deliver their harvest to the trader shop where it is weighed and payments are made to the farmer in cash. Sometime the payments are differed up to 1 week and 1 month being short of cash flows with trader.

In Balochistan and Sindh mostly farmers buy their daily life items on credits from the trader and re-adjust their debts at the time of harvest and start new credits every year and life goes on. Only big land lords are provided with the cash loans by the trader for any purpose including agricultural needs.

Grain sales Rates of Sorghum

In Punjab: DG Khan Rs: 2300-2500/100kgs bag

In Balochistan Rs: 2000/100 kgs bag

In Sindh: Rs: 3200/100 kgs bag

ONLY 2% are kept by farmers for next year seeds and remaining 98% is sold immediately after harvesting.

Mung and Mooth Beans

Mung and Mooth beans are regular crops of spate irrigation in Balochistan's Kachi Region and Sindh Province. In Punjab Spate irrigated of Dera Ghazi Khan and Rajanpur district farmer are not growing at commercial level or for outer sale. Only small quantity is cultivated mixed with sorghum and used at household level and small surplus quantities are gifted to relatives or sold at village level.

Mianwali and Bhakkar desert Regions and rain fed Potohar regions in Punjab province are growing Mung beans at large scale. A new business of mung beans and peanut plants is seen that is used as a dry fodder. Reportedly hundreds of small scale press machines are installed in these regions that collect the harvested plants from the farmer and bring in loads through local commission agents to press factories that press the plants remain and convert it into a compact wrapped bundle of 15kgs in weight. The compact dry fodder is then exported to Arab states where it is used for camel feed. The price per bundle is Rs: 400.

Contrary to Punjab, Balochistan and Sindh farmer collect the ripen plants of Mung and Mooth beans and dump them on a clean small ground to get dry under the sun. When plants are dried, the seeds are separated through a thresher machine and chuff called (Katti locally) is sold to the livestock herders against the Rs: 150 to 200/40 kgs.

Mung bean is widely grown in Pakistan even in canal and non canal areas including spate irrigation. Mooth bean can be termed as orphan crop which is disappearing from the country and only grown in (Kachi Balochistan and Thar Desert region of Sindh Province). Its production at country level is low and very good in taste mostly enjoyed by Hindus community of Sindh and Balochistan being vegetarian are the high consumer of the Mooth bean. It is not known elsewhere in Pakistan and not available in shops for sale in Punjab, KPK province and parts of Sindh and Balochistan markets. Pakistan is 30% short of pulses production to meet its country needs and Government has placed a ban on the export of pulses to keep the local market at moderate level for the country population.

SEEDS APPLICATION RATION

Mung and mooth beans are not cultivated as a single exclusive crop in spate irrigation areas of Pakistan rather it is grown mixed with sorghum crops. Probably due to the reason that farmer practice mix cropping to cope with the market if one crop yield is low then the other will cover in better way.

In acre: 10kgs Sorghum, 2 kg Mung and 6 Kgs Mooth beans are cultivated mix. In other case

In acre: 12 kgs Sorghum and 12 Kgs Mung and 2 kgs Mooth.

2 only percent are kept at home for local consumption and remaining 98% is sold immediately.

Cultivated by drill no broadcasting

Market Rates:

Grains Mooth: Rs: 3200-4200/100 kgs sack

Mung grains: 4500-5000/100kgs sack

Chuff: 4000-5000 truck load about: 800kgs

Major Market is Hyderabad for Sindh and the Traders in Balochistan buy from farmers and sell in Hyderabad.

Multan in Punjab is Major Market of Mung from Dera Ghazi Khan Traders. The traders do the sieving and separate the weaker grains and other stuff. The rates are different for sieved one and general packing.

GUAR SEEDS AND ITS REMAINS

Guar is dry region crop cultivated throughout the country including spate irrigated areas. In Punjab Minawali, Bhakkhar, Layyah, Muzaffar Garh desert area and DG Khan and Rajanpur spate irrigated areas are the major regions for the cultivation of guar crop.

In Balochistan it is cultivated in Khuzdar, Lasbella, Kachi, Jhal Magsi and Sibi Regions. It is normally grown mixed with sorghum and exclusive crop as well. Sandy and silt loam soil are best for its cultivation. It is drought resistant and survives moderately in absence of enough moisture. Its green pods are consumed and cooked at home seasonally. The crop is immediately

sold after the harvest. Chuff is its second product which is consumed by small ruminants and camels. The owners of such animal buy its chuff directly from the farmers.

Chuff rates are different in different areas probably due to insufficient or short availability. In Dera Ghazi Khan its chuff is measured to the proportionate of net grains. (*Chauth* which is equal to 16 *topa* is equal to 80Kgs) so it's per (*chauth*) chuff was sold last year against Rs: 2400 where its grain were sold 2300/100kgs bags. Current year there was no guar at large scale in DG Khan and Rajanpur Regions. So its Katti (chuff) is being sold at Rs: 7000 (per *chauth*). The guar rate varies throughout the year.

Being its physical characteristics the grains can be stored for years. Locally farmers also store it at home if the rates are low in the market. Traders also hoard it for longer time if the market rate falls to their actual purchase rate. It has 2 major varieties (Farmi and Desi). Farmi has come from India. Desi produces small grains where farmi produces bigger and healthy grain. Farmi is more grown in the canal irrigated area where water is available since it needs more water for maturity.

Marketing of Guar

Its major Market is Karachi where 11 processing plants are engaged and they are the only buyer of guar seeds. Farmers are not aware of its commercial value. Traders, however knows that a powder is extracted from the guar beans which is used by oil drilling industry, cosmetics and confectionery. Normally local traders buy from the farmers and send in loads to Karachi market. They sell the commodity through a broker rather than a factory owner.

Current market price:

In Punjab: 3000-3400/100kgs bag (last year)

In Balochistan 3300/100kga (Last year)

In Sindh: 10,000/100 bags bag (Current year) (the rates keeps on fluctuating)

SEEDS APPLICATION

20 kgs per acre are cultivated in case of exclusive cultivation. In mix 1/3rd of Guar is cultivated which is 7kgs and 13 kgs are sorghum.

SEASME SEEDS CROPS

This is water consuming crop and largely grown in canal area of all provinces. In spate irrigation areas it is cultivated in Jhal Magsi, Bolan in Balochistan and Thana Bola Khan in Sindh province where ground water is available alongside the spate water. First irrigation is applied by spate run off from the nearby Kirther Mountains and extracted through electricity tube wells and solar operated wells in Thana Bola Khan. It is harvested in second week of November cultivated in Mid-August respectively every year. It has only two varieties black and

white. White is more consumed and used than the black one. The seeds are usually purchased from the open market every year as farmers normally don't keep part of the crop to be used as next year seeds.

There is no evidence of oil extraction at commercial use rather it is consumed directly by using in breads, confectionery and food intakes in winter months.

SEEDS APPLICATION HARVESTING AND THRESHING:

2 kgs per acre seeds is applied.

When ripen farmer cut its plant almost from the middle (all seeds bearing branches) that carry seeds and leaving 1.5ft long wooden type of stubble on the ground to avoid more woody stuff. The cut branches are placed on the plain soil in conical shape to let the pods dried in the sun. When the pods get completely dried the branches are knocked again the soil on the splashed cotton sheet and seeds completely drop down on the cloth which are then collected and packed. The remaining plant woods have no other use than burning at home as a fuel wood.

In Punjab it is found that the empty plants are sold to the local Pathan who thresh them by a small machine and make a chuff out of it. The chuff then sold Rs: 150-200/40 kgs to the brick kilns owners who burn it as fuel. This practice is not common in Balochistan and sesame plant remains has no commercial use.

Marketing

Local farmers sell individually to the local traders normally at village and Tehsil Level. Farmers are always vigilant on the market price.

Current year Rate:

White seeds: Rs: 5500/40 kgs sack

Black: Rs: 5000/40 kg sack

Normally, a trader makes the local deal on rate and they collect the harvest from farmers or farmers deliver it to the trader at their stores. Transportation charges are mutually decided who will pay. In case if farmers pay the transport charge he charges it together with the total due bill against the traders. The weighing is done at both levels (at farm gate and at trader shop) in a scale to determine the total quantity. Labor charges of loading and unloading are paid by the trader.

Small Crops: White kidney beans are cultivated only in the Sindh spate regions but at small scale. It is cultivated mixed with the sorghum crops by ration of 3-4 kgs together with 10 kgs of sorghum per acre. When ripens, the beans are manually picked from the plants and placed on a certain place to let them dry. When dried they are cleaned manually. If cultivated independent crop it is applied 12 kgs per acre and the current rate is Rs: 90/kg.

CHAPTER -II

Extract of each Winter Season Crops from Cultivation to end use:

All spate irrigated in Pakistan depends on the summer rains to grow major summer crops. The summer crops are considered major crops of the regions. However, some time in a good year farmers gets rains from the last week of August-October and if there are floods and their lands are cultivated they go for the winter crops as well. Normally being the dropping rains seasons Aug-Oct, normally the land under winter crops gets moisture from 25% to 50% of the total command areas on certain irrigation system.

Major Winters Season Crops

- (1) Chickpeas
- (2) Wheat
- (3) Oil Seeds (Mustered 2 varieties e.g.(bitter and sweet)
- (4) Corianders

All these crops are cultivated from the mid of October to Mid of Dec finally every year in spate irrigated areas. Normally, the cultivation winter crops in spate irrigated areas are completed by end of Nov every year. These crops ripen 20 days earlier to the same crops cultivated on canal and tube well irrigated areas.

In Dera Ghazi Khan Punjab the chickpea is becoming major winter crop with comparison to wheat and oil seeds. Chickpeas make good price return upon sale.

Germination of wild plants is part of spate irrigated areas so when the fields are filled up with spate water and until it dry to the cultivation level, the weeds are cleaned manually before ploughing of seeds for any season crop. In Punjab Spate areas the cleaning of weeds is called (*Khaat*) in Balochistan (Kachi) it is called cleaning of (*Kandero*) a thorny bush that grows abundantly.

Mulching of land is only done for winter crops. After the irrigation in late July and early August when sun is still hot, the lands get dried quickly so to protect the moisture and soil cracking, farmer clean the soil from wild plants and thorny bush manually through an equipment called (*Wahola/Waholo*). The up rooted waste plants are burned down at the edges of the field. The soil is ploughed shallow (the cracks) depth and immediately then get is leveled smooth through a heavy wooden plank and wait for the rights days to come for cultivation of seeds.

Cultivation and harvesting of Chickpeas

The seeds are cultivated through second week of October to third week of November ideally. Normally the seeds are purchased by the farmer every year. Wheat and chickpeas are cultivated by drill methods rather than broadcasting. The oil seeds are broad casted and then ploughed.

Dera Ismail Khan in KPK, Dera Ghazi Khan and Rajanpur in Punjab are already growing black red variety of chickpeas from the year (Locally called Kala Chana and Surkh (red) varieties), Sindh Spate regions are growing white variety of the chickpeas locally called (*Satharie*) means 60s that ripen in 60 days.

Balochistan farming community was not much aware on the chickpeas cultivation and its nitrogen fixing effects on the soil. In 2016 black variety of chickpeas were provided to farmers that resulted in nice return. This year, they got spate water in late summers and opted for the chickpeas cultivation alongside the local wheat and oil seeds mustered at sizeable scale.

Farmers in Punjab rarely use chemical spray to protect the crops from pest attack. In severe cases it is observed that now farmer spray the young plants only if they find pest attack. Otherwise the sprays are not considered for any other reason.

In Sindh farmers are found to use the spray to protect the plant in the fears of pest attack. According to them once the crops is attacked by pest then they cannot be controlled after attack.

Seeds Application Ration

All varieties: 20 kgs per acre

Harvesting:

In the month of April the crops is ready to harvest. It is harvested manually and dumped in the central local to get further dry, when dried it is cleaned through a thresher machines. Farmer do not keep the seeds for next year. Since farmers are not sure to get late summer rains so the seeds are arranged from the local market. Farmers in Punjab and Balochistan buy seeds on cash. In Sindh province local traders provide the seeds on credits to the farmer and bound them to sell the harvest to them. In some cases even with the pre-determined sale rates are decided among the farmer and local trader before cultivation of crop. These rates normally lower than the actual market rates.

There is only Arid Zone Research Center of (NARC) National Agricultural Research Council in Dera Ismail Khan which supports the farmers in recommendation of varieties and provides them assistance in disease control. The center has developed new variety of chickpeas seeds called FIFA 2005 which is available to the Dera Ismail Khan Regions of spate irrigation. The quantity with the center is always small and does not reach to all the farmers. This year 800kgs of FIFA 2005 were procured on cost sharing for Kachi Balochistan Farmers and distributed among 7 farmers. The result will be monitored when the crop is ready.

Sindh farmers does not cut the plant shoots for increased bearing but farmers in Dera Ghazi Khan cut the chickpeas plant shoots before flowering with the belief that emerging new branches bear more pods. Farmer in Sindh informed that this myth is associated with black variety of chickpeas not all.

Marketing of Chickpeas:

Marketing is done through local traders and local traders send the loads of chickpeas to Karachi, Hyderabad, Lahore and Faisalabad Markets. The big traders in cities have (dall mills) where they remove the skins of grains and add the value and polish it for better look and then sell as a consumable final product with higher price. The grains removed skins is used for making animal feed.

Second major product of chickpea is its chuff which is used for animal feed. In DG Khan Spate areas it is sold to the livestock owners who store it to feed the animals in summer months or in rainy days when they cannot take their animals to the range. Rate varies depending on its cultivated area. In Dera Ghazi Khan, the size of spate area under chickpea cultivation is small so livestock owner book the (chuff or Kati) well in advance with the farmers. The price is Rs: 600-700 (per *chauth* equal to 80kgs net harvest) so if the net produce of certain farmer is (5 *chauth*), its chuff will be multiplied with (Rs: 600 by 5). Contrary to this, in Balochistan and Sindh it is used differently. For example Sindh farmer sell it to the brick kilns at Rs: 150-200/maund or per 40kgs. In Balochistan it has no much value and it is fed to the domestic animals and sale is not common probably due to availability of enough animal fodder.

Cultivation and Harvesting Wheat

One cannot say either wheat or chickpea is the major crop. Economically Poor farmer prefer wheat as he needs for home consumption while an average and rich farmer makes both choices to grow both crops (i) wheat for home consumption and (ii) Chickpea for sale. In DG Khan and Punjab Regions, the seeds are purchased from the market for cultivation. In Kachi Balochistan farmer keep all the harvest at home to use through year being larger family sizes. If they remain in their stock, they use it for seeds as well. Otherwise the seeds are purchased from the market for cultivation upon the moisture availability. The moisture for wheat and chickpea is not available every year to all farmers but some years are really good when large land is irrigated in late summer months Aug-October that leads to winter crops cultivation.

Seeds Ratio:

40-50kgs are applied in 1 acre. Preferably Maxi and Ratur variety are sown in spate irrigated areas in all spate regions. The names or characteristics of improved varieties are not known to the farmers in spate irrigated areas. So they cultivate any type of wheat seed that is available in the local markets.

Cultivation Season: It is cultivated from 1st week of November through second week of December in spate irrigated areas. In canal irrigated area its cultivation continues till the end of December every year. Winter rains adds further to its net produce.

Marketing of Spate Wheat:

Since it is not produced at a larger scale so its marketing is not common and every grower keep it for home consumption. Only big lands have surplus and they sell it to the local traders on the same rates as of canal command irrigated wheat. Sometime even they get low rates from the trader being its thin posture of grain and outlook. Current Market rate is Rs: 3000/100kg sack. Wheat is used as staple food throughout the country round the year. Rural households purchase and stock keeping in view their family size and make flour at local mills on monthly basis. The grinding rate is PRs: 50/40kgs and mill owner make the additional cut of 1kg besides the grinding cost.

The cuff is sold in the open market and usually local cattle owners, dairy farm owner buy and stock it for a year to feed the animals. The season rate of chuff is Rs: 15-180/40kgs. There are also local traders in rural villages that trade in the chuff business. They buy in the season at cheaper rate and sell off season in winter almost at double price ranging from Rs: 300-400/40kgs

Oil Seeds Crops (Two Types of Muster seeds Bitter and Sweet).

Oil seeds cultivation is spate irrigated areas throughout the country is 3rd major winter crops. Mainly two types of oil seeds are cultivated (i) *Jamba* in Balochistan and Sindh and *Aso* in Punjab (*tara mira* in urdu) is bitter in taste while one use its green leaf as green salad or cooked as vegetable. Its oil is also harsh when one apply it on the human body. (ii) Second is called *Sarsoon* in Urdu (*sarmi*) in Punjab spate irrigated regions. Its green leaf and twigs are used as vegetable and cooked like spinach and taste good and generally all folk throughout the country cook as celebrity intake in winter months when it is available. This crops is cultivated in both area canal fed agriculture and spate irrigated lands. The crushed oil of *sarsoon* is used for human body massage in summer months and used as gel to wet the hair throughout the year especially in rural areas. The bitter oil is used in summer months to repel and reduce mosquito bites and cleaned by the morning bath.

There is no evidence of its human consumption use in the country. However it is given to the small ruminants 20cc per day for one month to improve the animal digestion and its better look. The livestock herders feed it to the animals to which they plan to sell it and especially on the Goat slaughtering occasion called (Eid-Al-Dhua) in the Muslim world when they perform Haj and slaughter animals.

Seeds Application Ratio:

3kgs per acre both types of oil seeds are applied.

Oil Extraction Methods:

Traditionally every sizeable village has camel driven oil extraction mill which are not disappeared and just very few are left and can be find if one ask about its existence in certain village. But rural people like the mustered oil if extracted by animal driven mill since its take

long time to extract the oil which smells pure. On other hand mechanically extracted oil from machines is not widely liked since machine extracts the last drop from the seeds which mixes the (*Khal*) the spoils of seeds that left in mill completely dried. 5-7kgs seeds produce 1.5 to 2kgs oil. The spoils are called (*Khal*) which later sold to the cattle owners. Following the rates in different areas:

In Balochistan

Aso or Tara Mera bitter seeds: Rs: 35/kg Oil Rs: 220/kg

Sarsoon sweet mustard seeds Rs: 40/kg Oil 320/kg

Khal of both Rs: 40/Kg

In Punjab:

Aso or Tara Mera bitter seeds: Rs: 00/kg Oil Rs: 600/kg

Sarsoon sweet mustard seeds Rs: 00/kg Oil 400/kg

Khal of bitter variety Rs: 75/Kg bitter

Khaal Sweet variety mustered Rs: 40/kg

Coriander

Coriander is small scale crop which is cultivated by the Kachi farmers only in spate irrigated areas. Its seeds application ration is 3kgs per acre. Cultivation season is same as of wheat season.

In Punjab spate irrigated areas, it is only cultivated on a very small scale and is used as green coriander leaf. The left over are ripen and harvested and cleaned and used at domestic level.

Government Level Support to the Farmers

At district level two departments that are relevant to irrigation and agriculture are working (i) Agricultural Engineering Department who control and operate earth moving machines (ii) Agricultural Extension Department who provide technical support and guidance to the farmers by supporting them in introduction of new at field water management techniques, disease control and recommendation of pesticides, provision of subsidized seeds and fertilizers and over all guidance of farmers to get better crop returns.

Role of Agricultural Engineering Department

In KPK, Punjab and Balochistan province, Provincial Agricultural Engineering department is providing the earth moving machines to the farmer on the subsidized rates. Due to high demand of machines, 50% farmers are not getting them either due to financial constraints or machines are not available on time. Alternatively, tractors are hired directly by the communities for the purposes which are locally available in each village against Rs: 1200 per hour including POL for ploughing, erection of diversions structures, land leveling, harvesting of crops and agricultural transport.

In KPK bulldozers are kept with Agricultural Engineering Department but their usage authority is in the hands of District Rodh Kohi Department who extend the services to 620 diversions on 30 spate rivers in DI Khan district only. Upon the written request of farmer to Assistant Commissioner Rodh Kohi; the designated official visit the site and assess the numbers of hours required for the rehabilitation of diversion locally called (*kamara*). Once approved, the work order is issued to the Agricultural Engineering Department and machines are moved to the site to work. Annual fund for the purpose is Rs: 14.8 million and farmers do not make any payments. Insufficient funds are major constraint to extend the machine services to all the farmers on annual basis.

In Dera Ghazi Khan Agricultural Engineering department operate differently with comparison to KPK province. The department has 20 machines located at its tehsil office (i) Taunsa Sharif and (ii) Rajanpur and Jampur respectively. The department does not get annual budgets for development purposes accept the salaries and major repair of the machines. The machines are available to the farmers on following criteria round the year:

Nature of Work	Beneficiary	Make of Bulldozer	Hiring Rate (Per Hour) with condition
Agricultural Work	Small Farmers having ownership up to 12.50 Acres	Komatsu	Rs.560/- + diesel to be provided by the Department
	Big Farmers having ownership above 12.50 Acres	Komatsu	Rs.100/- + diesel to be provided by the user
Full Rate	Other Government Departments etc. for Agriculture Work	Komatsu	Rs.2120/- + diesel to be provided by the Department Rs.650/- + diesel to be provided by the user
Non-Agricultural Work	Contractor /Agency / Department / NGO etc.	Komatsu	Rs.2750/- + diesel to be provided by the Department Rs.1280/- + diesel to be provided by the user

In Balochistan province Agricultural Engineering department works with their own defined criterion. The machines are on the pool of department at district level and are shifted to the sites upon allocation of hours to farmers in different areas by the local MPs. Mostly in Balochistan, the machines availability is linked to the local political leaders with their developments funds which are transferred to the department and dozers hours are allocated to the farmers predominantly on political influence basis. This year 5000 bulldozers hours were distributed in different spate irrigation farmers only in Sibi District.

All in all the machines are not available to 50% of farmers despite their availability in timely manner. Secondly, the different policies and internal politics have reduced the efficiency of machines. Other than KPK province, poor segment of the spate communities have no access to the machine. The policies laid down in the so called criteria support to the rich farmers and machines are mostly used in their private farms.

In Sindh, department has machine available on subsidy rate to the spate forming communities as a result they cannot manage flood water and cant not develop new lands. Example is Pat Gul Mohammad that can be developed and irrigated from a Nai Gaj flow which passing in the western edge of Plain that can be diverted if new channels are excavated and embankment of lands is done.

Role of Agricultural Extension Department

Agricultural extension department is not contributing their services to the spate farming community anywhere in any province. They do get subsidized seeds and fertilizers which is distributed among influential farmers or sold out in black market. The services are only available in consultation for disease control upon the individual request of the farmers to whom

they recommend certain pesticides to control the flying insects. No new seeds are provided to farmers in the light change in climate change.

Additional Information

All crops cultivated in the spate irrigated areas are organic in nature which is not recognized in the country. Once the produce is reached to the market it is mixed up in the general product of the season without making distinction in its nutritional value being organic. This need to be identified in quantity and introduced its value at consumer level.

There are some foreign elements that damage the crops e.g. rodents attack the wheat crop in all spate irrigated areas. Farmers in Kachi Balochistan have informed that last year rodents have completely cut down the certain wheat field and reduced them to zero harvest. Porcupine also damages the crops. Wild migratory birds also attack the crops seasonally.

Prices of Packing Material

Use of jute bags is diminishing in country and plastic bags are replacing them. Normally 50kgs capacity bags are available in the market and now more at use. It has different varieties with different rates as per following details:

Jute bag of 100kgs capacity Rs: 80

100kgs capacity sack: net weight 75-80-100 grams for Rs: 18-30

50kgs Capacity sack: net weight: 70 gram Rs: 70

Finding and Recommendation

- There is need to introduce new crops to utilize the early, late and spring time moisture in the vague of climate change scenario.
- More investments by NGOs and government are desired to be shifted in spate sector for improved water management structures.
- In Kirther range farmers needs at large scale the field inlet and outlet structures to avoid the gullying and breaches.
- Subsidizes electricity in dry regions of Pakistan is required to enhance the agricultural production and poverty alleviation.
- The state occupied lands in Sindh specially and other parts of spate irrigated areas are desired to be re-distributed among the landless households.
- Farmer training and exposure are desired to enhance the knowledge in crop husbandry
- Tehsil and District level spate irrigation farmers' boards needs to be established for better planning with line departments.
- Range lands are desired to be improved together with farming communities.
- Improved drinking water and animal water ponds are desired to be constructed to store the flood water and ground water recharge.
- In Kirther Range of Sindh province there is more need to build small dam to improve the ground water situation.
- Village flood protection bunds are desired to be constructed in all villages that are in the commands of spate areas
- Building and construction of Erosion control structures
- Rural infrastructures are desired to be constructed like link road, improvement of bridle path in the range lands.
- Seeds exchange programs and farmers field days among the spate farming community are essential to know the environmental effects on production.
- Introduce less water consuming crops like Cumin and Fennel Seeds in spate areas as both of them are cash crops.