

An Examination of the Field Level Operations for Sugarcane in the Punjab State of India: How do these Bang upon Farming Systems?

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Introduction

- **Farm** - land area (includes structures for production & management of food, fibers and fuel).
 - Owned/operated - individuals, family, community, corporation or company
 - holding sizes - fraction to several thousand hectares; large farm/estate in a tropical/subtropical region refers to plantation and is monoculture and commercial (sugar cane one of the crops grown).
 - small mixed farms - combine crops
 - Households provide purpose, direction, objectives and management to whole farm system and its subsystems
 - Broad goals- domestic/ social vary with culture, tradition, commercialization and external influence; economic goal – security; non-economic - social acceptance
 - Main focus - production of low-risk sustainable subsistence crops and cash income generation
 - Other groups - influence through technology adoption, tenancy agreements, credit, price policy, etc.
 - Endogenous factors - household goals, labour, technologies, resource base; Exogenous factors - market development, shifts in demand, agricultural services & policies, new technologies, market and policy information - drive the evolution of individual farms thereby overall farming system (various farms at a single location at various stages of evolution)

Indian Scenario

- Family system

- Endogenous factors

- average holding size 1.33 ha, wide variations in farm sizes, agro-climatic conditions, socio-economic and cultural backgrounds of farmers at inter- and intra- regional levels

- External factors.

- introduction of green revolution technology for wheat and rice, central procurement for running the PDS gradually tilted the farming systems.

- Sugarcane Cultivation

- provides growers a regular income flow, crop can withstand vagaries of weather conditions, less supervision
 - area - 1.71 to 5.06mn ha; production - 57.05 to 348.19mn tones (1950-51 to 2007-08); Grown in tropical and subtropical regions
 - subtropical region - UP, Bihar, Haryana and Punjab (constitute about 50% to the total cane area); Punjab and Haryana also earlier adopter of Green Revolution technology but farmers also grow area specific alternative crops.

Objectives

- To examine farmers' asset positions and field operations
- How does cyclicalness of sugar industry and the existence of PDS interact and manifest the genesis of farming systems
- Study focus - Punjab State

Materials and Methods

- Primary data from selected farmers.
- All districts clubbed into three sub groups (based upon average cane production)
 - low (below 25 thou mt), medium (25 to 50 thou mt) and high (above 50 thou mt).
 - two sugar mills - one each from co-operative and private sectors from medium/high cane production areas; only a co-operative sugar mill from low cane production area.
 - Thirty six farmers from the command areas of five sample mills
 - Data collection - pre-structured schedules by personal interview method (cane marketing season 2005-06).

Farm Nature and Farming Motives

- Sample farms
 - family operated independent business enterprises with focus upon farming.
 - intuitive farming objectives – subsistence and requisite income.
 - Farmers combine several crops & animal husbandry each season
 - Crop specific cultivated area - driven by risk free markets for crop disposal and market prices for commercial crops
 - Farmers' objectives (cane) - subsistence, regular risk free income from crop/seed sales and innovations.
 - Overall farming and crop specific objectives - individual farmers asset positions both human (personal and social networks) and physical.
 - Number/crops types and field operations - vary across individual farms that depend upon soil and water conditions of a local area, distance from market, resource positions.

Table1: Background Characteristics of Respondents.

Characteristic	No.	% age	Characteristic	No.	% age
Age (Yrs)	30	16.66	Farming Engagement (Yrs)	122	67.77
Below 30	58	32.22	Hereditary	15	8.33
30-40	58	32.22	Up to 10	25	13.88
40-50	34	18.88	10-20	8	4.44
Above 50			20-30	10	5.55
			Above 30		
Education (Yrs)	11	6.11	Subsidiary Occupation	20	11.11
Illiterate	10	5.55	Own Business	8	4.44
Up to Primary	34	18.88	Govt. Services		
Prim. to Middle	92	51.11	Family Composition	46	25.55
Middle to Sr. Sec.	33	18.33	Nuclear	134	74.45
Above Sr. Sec.			Joint		
vi) Family Size (Average)		7.71			
Males		2.80			
Females		2.70			
Children below 18 Yrs		2.21			

Prim. – Primary, Sr. Sec. - Senior Secondary

Table 2: Farm Asset Positions of Respondents

Land (ha)	Total	Mean	Irrigation	Mean	Tractors	Mean
Not Leasing Land Owned Leased out	1055.15 20.00	11.86 ---	Owned Land Electric Motors Diesel Engines Diesel Engine & Generator	2.30 1.45 1.09		1.21
Leasing Land Owned Leased in	590.25 761.84	6.49 8.28	Leased Land Electric Motor Diesel Engines	2.96 1.28		
Combined Owned Net leased in	1646.00 753.74	9.15 4.18				
Total	2399.74	13.33				

Cropping Patterns-*Kharif* season

- **Shares in cultivated area**
 - Paddy- 52.08% (97.22% respondents)
 - Cane - 31.83%.
 - Other crops
 - Cotton-5.43%
 - Fodder- 4.99%
 - Maize - 1.44%
 - Basmati rice - 1.27%
 - Other minor crops s- 2.94%

Farmers' Asset Positions

- Existence of wide disparities for personal assets and holding sizes - opens up opportunities for experiments with farm operations thereby farming systems
- A larger concentration of respondents
 - age group - 30-50 years,
 - education level - Middle to Sr Sec
 - joint family system,
 - Hereditary characteristic of business enterprises
 - farming on owned land - sole occupation
- low values of characteristics
 - existence of limited scope for resource rich to try upon innovative farm practices.

Cultivable Practices

- Plant cultivation:
 - Ridge and furrows system with proper earthing up facilitates irrigation, improves soil aeration, provides plant support.
 - Bud sets from upper 1/3rd to 1/2 portion contains comparatively immature buds;
 - Bud set number/row length maintained uniform; planted at a spacing of 30-45cm
 - bud sets should be treated before planting; recommended planting period - Mid Feb till March.
- Ratoon cultivation
 - crop should be harvested from close to ground towards January ; saves cane cultivation cost (about Rs. 5000/acre); grass growth reduces yield during first year (about 40% but good supervision can reduce to 25%) but not much yield reduction during second year
- Nursery
 - seedlings raised using single bud sets that are transplanted in the field;
 - provides time for field preparation, saves seed cost due to reduced requirement (20 to 30 qtls/ha instead of 80 - 100 qtls/ha), better weed and fertilizer management, saves 2-3 irrigations, increases cane yield and uniformly matured stalk that enhances sugar recovery.
- Pit plant.
 - circular pots (about 90 cm diameters up to a depth of 45cm) dug out at distances of about 60cm and 90 cms; refilled with soil and Farm Yard Manure/press mud cake to a depth of 15cm; about 20 bud sets planted per pit and covered with soil.
 - gives higher yields but requires higher initial capital.

Table 3: Cane Cultivable Practices of Respondents.

Practice	No.	Area		No.	Area
Total			Single		
Plant	168 93.33	462.77 60.51	Plant	24 13.33	64.75 8.46
Ratoon	146 81.11	275.80 36.06	Ratoon	7 3.88	14.37 1.87
Nursery	14 7.77	12.95 1.69	Nursery	2 1.11	2.43 0.31
Pits	15 8.33	13.15 1.72			
Combined Two			Combined Three		
Plant & Ratoon	123 68.33	534.80 69.93	Plant, Ratoon & Pits	7 3.88	77.70 10.16
Plant & Pits	4 2.22	13.56 1.77	Plant, Ratoon & Nursery	6 3.33	3.24 0.42
Ratoon & Pits	2 1.11	4.45 0.58	Plant, Pits & Nursery	2 1.11	7.28 0.95
Plant & Nursery	2 1.11	8.90 1.16	Ratoon, Pits & Nursery	1 0.55	3.64 0.47

Table 4: Cane Varieties Sown by Respondents.

Variety	No.	Single	Combinations	Two
CoJ-85	97 53.88	40 22.22	CoJ-85 & CoJ-89003	17 9.44
CoJ-89003	56 31.11	13 7.22	CoJ-83 & CoJ-89003	11 6.11
CoJ-83	53 29.44	11 6.11	CoJ-83 & CoJ-85	11 6.11
CoJ-64	16 8.88	4 2.22	Main variety & other Variety	12 6.66
CoJ-92	15 8.33	5 2.77	All other varieties	7 3.88
CoJ-88	43 23.88	26 14.44		
CoJ-8436	40 22.22	23 12.77		
CoJ-88230	16 8.88	10 5.55		
CoJ-89	36 20.00	18 10.00		

Input Use Patterns

- Use of FYM/press mud recommended before cane planting
 - provides essential nutrients for plant growth and reduces nitrogen intake - 60 to 40kg/acre.
 - About 3/4th respondents used farm manure; 97.77% used DAP; all used urea.
 - 47.22% respondents prepared FYM as well as purchased it fellow farmers; 24.45% prepared it themselves; only 2.22% purchased it from fellow farmers
 - Farmers used several plant protection measures
 - major three - gamma, indosulfan and furadan/furadax were used by 75.54%, 62.21% and 48.88%
 - 14.44% of them used amison
 - zinc sulphate, thinat and contidal - only about 2%

Table 5: Respondents' Labour Use Patterns

Nature	Cane Sowing			Hoeing			Cane Tying	
	Farmers	Area	No.	Farmers	Area	No.	Farmers	Area
Only Hired	172	735.94	Nil	66	227.64	Nil	34	124.04
	95.55	96.03		36.66	29.70		18.89	16.18
Hired & Family	5	26.91	One	58	254.15	One	73	334.68
	2.78	3.51		32.22	33.16		40.55	43.67
Only Family	2	2.43	Two	45	209.63	Two	63	252.93
	1.11	0.31		25.00	27.35		35.00	33.00
Family & Neighbours	1	1.01	Three	11	74.87	Three	10	54.63
	0.56	0.13		6.11	9.77		5.55	7.12

Farm Operations

- **Cane hoeing**

- 36.66% respondents – nil as they used herbicides or adopted preventive measures such as spreading trash blanket between cane rows or intercropped cane with other crops.
- 63.34% respondents - hoeings from one to three.
- Area under one, two and three hoeings - 33.16%, 27.35% and 9.77% of cane cultivated area; percentages of respondents 32.23%, 25% and 6.11%.

- **Cane tying**

- 18.89% respondents – no tying for want of labour availability or selection of dwarf cane varieties.
- 81.11% farmers got cane tied – once to thrice
- area under one, two and three tyings - 43.67%, 33% and 7.12% of total cane cultivated area; percentages of respondents 40.55%, 35% and 5.55% .
- Farmers paid higher wage costs for each successive tying -Rs. 437.25/acre for first, Rs. 614.07/acre for second while Rs. 770.77/acre for third tying

Various Farm Operations

- About 99% respondents opted for those cane cultivable practices that provide them assured markets for cane disposal while only about 15% experimented with the capital intensive cultivable practices;
- About 95% respondents opted for early sowing, about 44% for mid sowing while 20% for the late sowing cane varieties; CoJ85 emerged as the single largest early variety;
- Variety selection choices and various farm operations management depended upon several endogenous factors such as knowledge, experience, personal networks, proximity to mills, risk bearing capacity, cash position and exogenous factors such as labour availability, soil and water conditions.

External Influences

- Sugar industry
 - ownership - state owned cooperatives and private mills.
- Industry remains regulated along the entire supply chain though gradually liberalized since the 1990s. Results
 - Cooperative mills particularly during the downward phase fail to make timely full cane payments to cane growers.
 - Cane growers divert cane supplies to private sugar mills that offer higher prices, make on the spot cash payments and offer incentives at mill gates
 - Farmers also divert a sizeable proportion of cane area to the cultivation of alternative crops such as paddy (basmati and permal) or cotton which they can sell through CAs who can oblige their client farmers in case of any cash contingencies.
 - The phenomenon continues to persist till the revival of upward phase of industry or government induced policy changes such as upward revision of SAPs.
- Regulated markets for major staples
 - introduced flexibility for farming systems.

Conclusions

- Notwithstanding variances in farmers' asset positions in diverse agro-climatic conditions they resort to several crop specific farming operations in developing countries.
- A large majority of farmers tend to concentrate upon the prevailing risk free farming practices while only a handful resourceful farmers experiment with the capital intensive cultivable practices.
- External factors largely a manifestation of the macro level environment (crop specific and general) also impact the farming system.
- Combined interactions of endogenous and endogenous factors induce medium to long term changes in the farming systems. Former are primarily oscillatory in nature while latter provide consistent and assured markets and appear to be more or less permanent in nature till next major breakthroughs.

Conclusions-contd

- Plant cultivable practice
 - most important - occupied 60.51% of cane cultivated area (93.33% farmers practiced it).
 - Preference reasons: higher yield, lesser grass growth and benefit of inter cropping.
- Ratoon cultivable practice
 - Occupied 36.06% cane area (81.11% respondents opted it)
 - Preference reasons: mills' preference, higher juice content, cost saving, time saving and non-availability of labour or finance in time. T
- Nursery and pit plant cultivable practices
 - Occupied 3.41% cane cultivated area (about 16% respondents opted it).
- Combined two cultivable practices
 - Plant and ratoon occupied 69.93% of cane cultivated area (68.33% respondents opted it)

