Cotton Cultivation And Ground Water Development In Vidarbha

SJ Phansalkar
Mansoor Khorasi

I. Introduction

Analysis of the secondary data seems to indicate simultaneous existence of wide scale cotton cultivation, significantly under-utilized ground water potential and fairly high incidence of poverty in the cotton tract (Wardha, Yavatmal, Chandrapur, Akola, Washim and Amrawati) of Vidarbha[47]. Development of surface water irrigation sources has been significantly and adversely affected in Vidarbha due to the peculiarities of the "zudapi jungle" provisions of the Forest Conservation Act, as well as deliberate neglect on the part of the State[48]. But these factors need have no impact on ground water irrigation. The implementation of the Ground Water Regulation, which could have retarded ground water development, is of relatively recent origin. Village electrification is said to be 100% in these areas, though on the ground one hears a number of complaints about massive delays in getting new connections[49]. Thus the factor external to the farmers discouraging ground water irrigation is electricity supply. Diesel engine based pumps offer an alternative to this problem as is seen in energy poor regions of India. In fact ground water irrigation is completely decentralized in the sense that both the investment and returns are purely private, invariably accruing to individual farmers. Access to ground water is somewhat uncertain given the trap-soil on basaltic trap formation that dominates the whole cotton tract. There is thus a major uncertainty about locating new and rich points for wells. We would like to argue that this does not explain the underutilization of ground water fully. Had there been a significant agricultural enterprise or known and demonstrated possibility of crop combinations that give much better incomes than existing crops, one would have seen more efforts to exploit ground water potential on the part of the farmers. Hence we were led to believe that cotton crop seems to act as an unfavorable intervening variable for ground water development. That is why we chose to explore the relationship between cotton crop and ground water development.

II Research Questions:

Our main aim is to explore the relationship between incidence of cotton cultivation and pace of development of ground water resources. This interaction occurs through a number of intermediary factors. Farmers' decision making based on their perception of risk of ground water development, the investment and their own assessment of the returns vis a vis this investment are some of the intermediary variables.

The research questions of interest are then the following:

---

[47] Phansalkar SJ, "Understanding Underdevelopment", a paper presented at the Second Partners' Meeting of IWMI-Tata Programme, Anand 2003.
[48] SJ Phansalkar, "Political Economy of Irrigation Development in Vidarbha", IWMI-Tata Programmed, February 2003.
[49] See daily *Tarun Bharat*, Nagpur, dated April 5, 2003

a) What is the pace of efforts of accessing ground water in the cotton tract of Vidarbha? Can it be concluded that this pace is slow?
b) What factors determine the pace of ground water exploitation by farmers in the cotton tract?
c) Can it be inferred that investment in a ground water irrigation is not rewarding if it were to be used mainly for irrigating cotton?
d) What is the economics of cotton cultivation? What factors contribute to farmers adhering to cotton crop particularly in view of the perpetual uncertainties in marketing and payment for cotton?
e) If current non-availability of irrigation prevents farmers from giving up cotton in favour of alternate cropping combination, then what prevents them from accessing irrigation so that these combinations would be feasible a year down the line?
f) Can it then be concluded that cotton crop is indeed an unfavourable intervening variable in ground water development? What are the policy implications of this situation and what steps are indicated?

As is clear from the questions, this was an exploratory research.

III. Methodology and Data Presentation:

We relied mainly on a focused survey of cotton growers as well other farmers in the cotton tract of Vidarbha. Data was gathered through a structured questionnaire. This was administered to hundred and seven farmers in some seven villages of Yavatmal and four villages of Amrawati district. Mansoor Khorasi, a seasoned NGO worker adept at building rapport and conducting participative research with farmers conducted the field study. Detailed discussions were done with fewer farmers for obtaining representative data for conducting economic analysis as will be reported below. The data gathered was analyzed for obtaining the information that helped us draw inferences on the following issues:

a. comparative economics of crops under dry condition
b. comparative economics of irrigated crops.
c. why do people think of making wells? Who makes the well?
d. Costing of well
e. Relating cost of well with returns
f. why do people not adopt vegetable crops?
g. Why do people not shift to soyabean-gram combination
h. What is the pace of well development?
i. Why is this pace slow
j. Why do people continue to grow cotton

After quickly profiling the villages and the overall socio-economic situation, we present and discuss the data on these issues.

3.1 Overall regional profile: The number of households in villages chosen for the study ranged from 200 to 1200. The largest village had a market yard of the APMC. The remaining were located between 3 and 20 km from the nearest market yard. All the villages fall in the deccan trap region. Yavatmal had a much more undulating terrain. Lands on hill slopes (with gradients up to even 5%) have relatively thin and eroded soils.

Plain lands have heavy trap soils that tend to get water logged in July-August which period invariably sees one or two bouts of a week long intense rainfall. Only one village had access to canal water for irrigation. Average land holding in these villages was about 2 Ha. Average well density is about one well in 26 Ha. The number of pumps is about 65% of the number of wells. Thus not all wells are used for irrigating the farms. 4800 Ha. Of the total 7700 (62%) Ha land in villages surveyed from Yavatmal district was under cotton. This proportion rises to almost hundred percent when one focuses on plain lands. Other kharif crops include sorghum, pigeon pea, soybean, green gram and black gram. The most important rabi crops were wheat and gram. Only those farmers whose lands benefited from the dam also undertook summer cultivation, usually sowing ground nut. Almost 90% of the bovine animals were cattle and the proportion of cows in cattle averaged 30%. There was a substantial goat population particularly in villages on the forest fringes.

3.2 Comparative Economics of cotton crop under dry (rainfed) conditions

This was aimed at assessing whether cotton enjoys overwhelming superiority under rain-fed conditions. Comparison is made with soy-tur intercrop.

Table 1

SN	Cost Head/Revenue Head	Volume/quantity	Cost per acre of cotton	Cost per acre of intercrop Soy-tur
1	Land preparation	Involves clearing the field, 3 times plough etc	600	600
2	Seeds		1100	450
3	Inter-culture	2 times at least	300	300
4	Manures and fertilizers	Includes urea/dap and FYM	675	675
5	Pesticides	Mainly for cotton, at least 3 sprays	400	0
6	Harvesting	Labour	450	200
7	Total per acre		3525	2225
8	VoP per acre	Cotton yields 3 Q, soyabean yield 3 Q and tur yield of 1 q	6000	4800
9	Cash surplus		2425	2575

Despite the fact that farmers received a price of Rs. 2000 per quintal of cotton against much lower prices last year cotton is not more profitable compared to soybean-tur combination. This is clear. Yet cotton dominates. This is intriguing. Before presenting the reasons for domination of cotton crop in the land allocations, we look at the economics of different crop combinations under irrigated conditions.

3.3 Comparative Economics of Different crop combinations under irrigated conditions:

As per the data about wells collected through the survey, dug wells are the principal sources of irrigation for farmers in these villages. The water column in the wells is adequate for irrigating land only up to the month of March in most of the villages. In the exceptional case of villages where the farm land is in the command of a dam and also gets advantage of recharge of ground water aquifers from the dams, is it possible to irrigate any summer crop. Thus effectively, the time period for considering crop

combinations is June 10 to March 31. Given the compulsions of appropriate sowing dates etc, the following crop combinations under irrigated condition are deemed to be possible. These are also seen in practice:

Kharif	followed by	**Rabi**
Cotton	→	cotton continues
Cotton early variety		wheat
Soybean		gram
Soybean		wheat
Cotton + Tur		continues
Cotton (early harvesting)		groundnut
Soybean		ground nut

While the survey collected detailed information on cropping practices and input costs, we present basically summary information relevant here. The net returns per acre of these combinations are given below.

Table 2

SN	Crop Combination	Net Return (Rs/acre)	Remarks
1	Irrigated cotton alone	4250	As per yields and prices of 2002-03
2	Irrigated cotton + tur	4870	
3	Soybean – wheat	9751	
4	Soybean-gram	8411	
5	Soybean-groundnut	9953	
6	Cotton-wheat	9060	
7	Cotton-groundnut	8462	
8	Tomato	14100	

Source: Field Survey

Cotton followed by any other crop seems to be less remunerative than corresponding combination with soybean. Further, cotton is far more pest prone with unending bouts of boll worm attacking the crop. The consequent impact on costs of pesticides, indebtedness and disastrous impact on household economy (some times leading even to suicide is well known.)

On balance it would appear that the soya-tur intercrop is superior to cotton in kharif and soybean followed by any rabi crop is better than cotton followed by a rabi crop if one has irrigation. It is true that the current year's price for soybean has been much higher than previous few years and hence farmers have turned in favour of soybean. Yet, soybean-tur combination has really not become very popular. Why do farmers grow cotton instead of soybean then? Some of the answers revealed by the survey are as follows:

- Cotton crop seems to enhance credit standing of the farmers with traders. Traders regard a standing cotton crop as some kind of an assurance of a minimum repayment guarantee.

- Soybean and tur can grow well in relatively better soils while cotton can be planted and can grow even in undulating soils and hence is preferred.
- Cotton harvest is a long drawn process and hence offers better security to farmers. As against this, both soybean and tur are single flowering-one time harvest type crop. Any unfavourable weather condition at the time of flowering of tur for instance ruins the whole crop.
- Market for soybean is less well developed in this belt than market for cotton. Also, for last several years starting from 1997, soybean market was severely depressed. This year farmers saw a boom in soybean market.
- There is the mind-set issue. Cotton tract farmers produce enough sorghum on their other plots for them to have home grown food for most of the year. Intercropped tur gives them the pulses. Cotton has always been their cash crop.
- Several persons have suggested that cotton is in a way a lazy man's best option. Barring the requirement of two inter-culture operations it does not need much tending nor does it have And except in years of unusually severe attacks of the boll worm, the crop is fairly sturdy. The GoM Monopoly Scheme had more or less eliminated the market risks. A great deal of noise and politics has always accompanied any significant effort to substantially do away with the scheme and this makes people believe that the scheme is for ever.

However, it must be noted that a slow trend towards soybean is in fact emerging. Yavatmal-Amrawati are lagging behind in this respect compared to neighbouring Nagpur and Wardha districts where soybean processing units came up almost a decade back and markets developed for soybean.

Unless farmers shift to commercial horticulture, they find cultivation like tomato a difficult proposition for reasons other than water availability. Some of these reasons are:

- These villages are remote and till very recently suffered from very poor infrastructure. Even now, market linkages are not properly established.
- Commercial horticulture needs a significant amount of capital to be risked. This is well beyond the reach of average farmers owning a few hectares of land.
- When done on a small scale, farmers find it difficult to market their produce since their production does not make one full marketable /transportable lot.
- These crops need a great deal of specialized knowledge and expertise that most farmers in Vidarbha do not have,
- Finally, crops like tomato also need intensive care and this is incompatible with the life style of most native Vidarbha farmers.

3.4 In the seven villages for which data is available, the number of wells has risen from 210 fifteen - twenty years back to 307 this year. There is no bore well as of now. Yet, the

ground water potential of this region is significantly underutilized at just under 30% as shown in the box below.[50]

SN	% ground water development	# talukas in Vidarbha
1	less than 10%	47
2	between 10 and 30%	41
3	> thirty percent	13
4	total for which data is available	106
5	Talukas that are at risk	5

(all the talukas at risk and those having ground water development above 30% are along the Northern fringe of Vidarbha, mostly in the orange belt.

Considering the potential, it appears that the pace of ground water development is really slow. Hence it is important to understand why is this so.

We present the investment analysis for a "typical dug well" in this region. This well has a diameter of about 7 metres and a depth of about 12 metres. The well is lined for the top three metres with 4" thick RCC lining. The well can be constructed after a number of blasts since one hits hard basalt in this area at a depth of about 4 metres. The cost including earthwork, blasting and RCC lining comes to about Rs. 70000/-. The cost of either an electric pump or a diesel engine based pump is about Rs. 15000/-. The total cost of electrification (if electric connection is obtained) is Rs. 8000/-. Finally, pipeline costs about Rs. 7000/- Thus the total cost is Rs. 100,000/-. The current interest rate even for well-off farmers is about 2% per month and hence this translates into Rs. 24000 per year of interest cost. This well is able to irrigate 5 acres of cotton crop in kharif (life saving irrigation) and depending on water availability, may irrigate up to 3 acres of a rabi crop. The well may increase the yield from a mere Rs. 2425 for dry cotton per acre to a annual return of Rs. 8400 for a two season crop such as soybean-gram valued at 2002-3 prices and yields which have been said to be exceptionally good for these crops. The well will generate at the most an incremental Rs. 30000/- if it can irrigate all the five acres, but more likely generate an extra Rs. 18000 per year from three irrigated acres. If the well is unable to irrigate any rabi crop due to either failure of monsoon or due to erratic power supply or factors like this, then the impact is essentially in terms of stabilizing kharif crop. This calculation assumes that irrigation is being done using conventional flood system needing 4 hours of pumping per acre and a power availability of about 10 hours a day in peak rabi season. The incremental return thus possibly falls short of opportunity cost of the capital (as experienced by an average farmer). This perhaps

[50] See Amol Management Consultants "Water Use in Agriculture in Vidarbha: A status Report" submitted to IWMI, Nov. 2002, page 5

explains why the pace of development of ground water is slow in this part. One must note that there is a significant risk in digging a well since in hard rock regions getting water bearing wells is uncertain and that there is a significant waiting time for new electric connections. When the uncertainty and time delay angles are added to this analysis, the economic merit of digging a well becomes even less attractive. Just one extra attempt to sink a well if the first fails reduces the IRR from a high twenties to just about 3-4%! The Table 3 below sums up this discussion formally.

Table 3: Investment analysis for a typical dug well

Item	Year 1	Y 2	Y3	Y 4	Y5	Y6	Y7
Capital cost of well	70						
Capital Cost of pump etc.	22						
Cost of electric connection	8.0						
Annual power cost (3 HP)	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Annual maintenance		1	1	3	2	2	2
Outflow	103.3	4.3	4.3	6.3	5.3	5.3	5.3
Extra income due to stable kharif crop 5 acres	12.2	12.2	12.2	12.2	12.2	12.2	12.2
Extra income due to irrigated rabi crop 3 acres (20 Q gram)	18	18	18	18	18	18	18
Total inflow	30.2	30.2	30.2	30.2	30.2	30.2	30.2
Net inflow	-70.1	25.9	25.9	23.9	24.9	24.9	24.9
IRR under normal expectation	28%						
Inflows if No rabi as an Impact of low water content in well or power problem	-88.1	12.2	12.2	12.2	12.2	12.2	12.2
IRR pessimistic	-5%						
Assuming one well fails and hence two must be built	-138.1	25.9	25.9	23.9	24.9	24.9	24.9
IRR	3%						

Who then makes new wells and why? In a certain sense this question is some what akin to asking who builds new houses in cities and why. Unlike urban investment situation, there is a subsidy element here.

- The first reason of course is that many farmers are able to get advantage of Government schemes such as the million well scheme under which they do get 50% subsidy on well construction. Whether the subsidy is well directed to those below poverty line etc. is beside the point. (It appears that the whole region does need investment subsidy for wells!) Even after meeting the inevitable transactions costs, with such a subsidy, the capital cost does come down for the farmers and the economics improves.
- Secondly, there is the "safe investment" consideration. Our survey reveals that the majority of those farmers who invest in wells are those who also have alternate sources of income (such as trade, government jobs etc.)

Clearly they believe that investing in a well is better than lending the money in the market at the rate mentioned above, since that would entail costs of follow up and recovery. Besides, well is a quasi-permanent asset and a proven well improves the value of the land significantly.

- The fact that own wells stabilizes the income flows is also a very important consideration. Thus we see farmers taking the trouble of diggina well and mechanizing it over a period of two to three years using all the family savings so that their future becomes more safe.
- Thirdly, for families with a certain social standing, ownership of a well is more or less expected. They must have their own well if only for meeting drinking water and household requirement. Their womenfolk certainly can not go fetching drinking water from wells of lesser farmers!
- Fourthly, those farmers who are enterprising enough to take to horticulture certainly find the investment well worth making. Such farmers in fact try and sink as many wells as they can for taking horticultural crops round the year.
- Finally, there is always the hope that if one strikes a rich water source, then one can graduate to becoming an orange planter! Having an orange plantation is a long standing ambition of most farmers in Western Vidarbha since it connotes rural wealth and a sign of having arrived in some sense.

IV. Discussion

4.1 Summary of the data and the analysis

We thus find that the interrelationship between cotton cultivation and ground water is complex. Cotton is certainly not the best or the most profitable crop whether in rain-fed or in irrigated conditions by any means given available current crop choices. Yet several factors bind farmers to cotton. These include of course a mindset born out of a century of cotton cultivation here, the easy liquidity and marketability of cotton crop, the indebtedness cycle that makes people continue with cotton irrespective of their desire, the fact that light and sloppy soils do not permit too many options given current status of agronomy and technology, the buffering of market risk due to State intervention an the fact that it is a multi-harvest type crop and hence has reduced risk of complete failure. There is a slow withdrawal from cotton but the shift to soybean has been retarded in recent times due to a slump in soybean market between 1997-2001. The farmer's life style and work habits, market access, infrastructure and current stock of knowledge of

agronomy and irrigation technology and large price and production risk prevents him from taking to irrigated commercial horticulture.

However, once cotton takes the central place in farm economy, as the 62% land allocation to cotton suggests, it starts interfering with resource development. It is a long duration crop and hence restricts crop choices for rabi even if one has access to irrigation. Cotton thus pushes people deep into subsistence economy, where the sorghum and pigeon pea give him the food and cotton the bare minimum cash he needs to stay afloat and meet some cash expenditure. An average farmer with no access to non-farm income nor to State subsidies finds no possibility of investing in a well. The returns do not merit it so long as he remains within the paradigm of cotton + a rabi crop. The pace of ground water exploitation is slowed down in part by difficult resource attributes and in part by the adherence to cotton crop.

4.2 Is this then a problem? And whose problem is it any way?

The fact that the whole cotton tract is also among the poorer regions of the country makes the above situation problematic. One has to look at per capita incomes for these districts, the CMIE development indices, or any other index of rural income level to recognize the wide scale and intense poverty here. The Table below sums up all available data on these counts. If further evidence were needed, it may be noted that Yavatmal is classified among the poorest hundred districts of India by programmes such as the PACS of DFID.

Table 4 : How poor is the cotton tract?

District	CMIE Devp Index	Per capita income (Rs. Per annum for 1993)	Market potential index
Yavatmal	64	7569	0.76
Washim	65	7254	0.88
Akola	65	7253	0.88
Amrawati	74	7245	0.8
Buldhana	59	6587	1

Source: CMIE development index: "Profiles of Disticts", CMIE, Nov. 1993
Per capita income: Report of the Irrigation Commission, GoM, 2000
< arke potential index derived from BBDO-RK Swamy Market Potential

It is clear that irrigation can go a far way in addressing and reversing the poverty. The whole region has plenty of rainfall and a large number of streams. The irrigation development in cotton tract has suffered for a long time due to deliberate State neglect.

This has been documented in an accompanying paper as noted earlier. The State is bankrupt and has no possibility of raising money from the market for creating irrigation infrastructure. Hence there is very little hope of significant investments coming in the creation of surface water sources. Thus the burden of reducing poverty falls on ground water exploitation which is largely in private sector. Since this itself is strongly and negatively influenced by cotton cultivation, we believe there is a major problem here.

Yet since people cultivate cotton seemingly on their volition, they do not seem to have recognised the subtle but definite negative influence of cotton on ground water development. A part of the reason also is that they are aware only of flooding type irrigation as they think the conventional drips to be well beyond their reach. Finally, they do not seem to be particularly impressed with the need to shift cropping pattern for better income. They would rather revert back to the monopoly scheme rather than take entrepreneurial choices for finding more lucrative crops and markets. Thus the people do perceive a problem but the problem definition seems to be faulty. Their problem definition is to eliminate downward price risk in cotton and obtain state support in the event of virulent pest attacks.

4.3 Conclusions and Implications

We find that the relationship between cotton cultivation and ground water exploitation is indirect and negative. We also find that the pace of ground water exploitation in cotton tract is also quite slow. We believe that while the easy liquidity and similar other factors of cotton crop tend to perpetuate it, one important reason for poor adoption of alternate crops is the fact that people lack adequate information and access to technologies that can save water and yield more crop per drop. We conjecture that since they have always been growing cotton, they are well aware and familiar with the travails of cotton cultivation and marketing. Risks of other crops are perhaps wholly new for them. The people seem to be content to be in their low level equilibrium. Yet from a wider poverty perspective, it is important to assist the people by demonstrating new and more paying crop combinations as well as new and better water delivery mechanisms so that the economics of wells improves and the unused ground water is put to productive use.