

Chapter 6 - Household characteristics and determinants of farmers participation in contract farming

One of the objectives of the thesis was to understand the inclusiveness aspects of contract farming. Here, inclusiveness refers to which kind of farmers participate in contract farming. As discussed in Sections 1.3 and 3.1.1., there are a group of people and studies which advocate that contract farming benefits mostly large farmers as small farmers are excluded from this value chain. This chapter discusses the question of whether CF tends to be better endowed than NCF. According to Shah (2013), socio-economic characteristics of farmers have a profound influence on the decision-making process and profitability of crop enterprise. In general, this chapter focuses on socio-demographic profile and farm related characteristics of sample farmers household as well as the characteristics of their operational holdings and the cropping pattern (Sections 6.1 and 0). The chapter also discusses the profile of farmers who participate in the contract (CF), who have left contracting (ACF) and who have never participated in the contract (NNCF). Using Logit regression analysis, the determinants of farmers' participation in contract farming is discussed (Section 6.3).

6.1 Socioeconomic and demographic profile

In this section, the comparison of the information relating to household size and dependency ratio, education status, and composition of the social group and agricultural assets, etc., for CGP and onion CF and NCF (including ACF and NNCF) is done.

6.1.1 Gender, Social Group and Occupation

Here, the comparison of the socio-demographic characteristics between CF and NCF is discussed. It was observed during the CGP and onion survey, that there was no caste and gender bias made by contracting firms while offering seeds on contract. The gender, social group and occupational profile of sample CGP and onion farmers' have been presented in Table 6.1 and 6.2. Most of the farmers in both the sample groups are male. During the village enumeration, it was observed that although, there were very few female-headed farming households, they were not averse in growing the chip-grade potato under contracting. The majority of the farmers in the CGP sample belonged to the general category of social group, i.e., 80% of CF and 89% of the NCF households, while

rest belonged to backward classes²⁶. While majority of the onion sample farmers belonged to OBC general category of social group, i.e., 77% of CF and 90% of the NCF households, while 17% of CF and 7% of NCF belonged to general category

There seems to be not much difference in the occupational profile of CF and NCF of both the onion and CGP farmers. Almost all CGP sample growers have to farm as their main occupation, and more than half have dairy/poultry as a subsidiary occupation. While 28% of CGP CF and NCF had no subsidiary occupation (Table 6.1). There were two ACF from Pune, who had left growing CGP in the contract and instead themselves became potato commission agents (non-contract hundekari). These agents go to Punjab and buy the seed tubers from farmers there and sell it to the growers in their village. In the case of onion, all growers have farming as their main occupation, and around one-third have dairy/poultry/sheep rearing as a subsidiary occupation. And around half did not have any subsidiary occupation. Here, it seems there are not major differences between CF and NCF in terms of occupational profile.

Table 6.1 Gender, Social Group, and Occupational Profile of CGP Farmers

Particulars	CF ($n_1=89$)	Non-Contract farmer (NCF)		
		ACF ($n_2=33$)	NNCF ($n_3=56$)	NCF ($n_2+n_3=89$)
Gender				
Male	95.5	100.0	98.2	98.9
Female	4.5	0.0	1.8	1.1
Social Group				
General	79.8	84.8	91.1	88.8
OBC	16.9	12.1	3.6	6.7
SC/ST/NT	3.4	3.0	5.4	4.5
Main Occupation				
Farming	98.9	97.0	98.2	97.8
Poultry/Sheep rearing	0	0.0	1.8	1.1
Non-farm (non-agri labour/service/ shop)	1.1	3.0	0	1.1
Subsidiary occupation				
Dairy	53.9	54.5	58.9	57.3
None	28.1	30.3	26.8	28.1
Non-Farm (Non-agri labour/ transport/ shop)	15.7	6.1	12.5	10.1
Agri-labour/ Farming	2.2	3.0	1.8	2.2
Potato commission agent	0.0	6.1	0.0	2.2

Source: Computed from primary survey (2012-13)

Note. Units in percentage and have been calculated on column sums

²⁶The term “backward classes” comprises of four sections of Indian society viz. Scheduled Castes (SC), Scheduled Tribes (ST), Other Backward Communities (OBC) and Denotified communities (Revankar, 1971).

Table 6.2: Gender, Social Group and Occupational Profile of Onion Farmers

Particulars	CF ($n_1=108$)	NCF		
		ACF ($n_2=48$)	NNCF ($n_3=44$)	NCF ($n_2+n_3=92$)
Gender				
Male	99.1	97.9	97.7	97.8
Female	0.9	2.1	2.3	2.2
Social Group				
OBC	76.9	89.6	90.9	90.2
General	17.6	6.2	6.8	6.5
SC/ST/NT	5.6	4.0	2.3	3.3
Main Occupation				
Farming	99.1	100.0	97.7	98.9
Non-Farm (Non-agri labour/Service)	0.9	0.0	2.3	1.1
Subsidiary occupation				
Dairy/poultry/sheep	52.8	33.3	34.1	33.7
Non-Farm (Non-agri labor/Transport/Shop)	3.7	18.8	2.3	10.9
Agri-labour/ Farming	0.0	0.0	4.6	2.1
None	43.5	47.9	59.1	53.3

Source: Computed from primary survey (2012)

Note. Units in percentage and have been calculated on column sums

Overall, there was no major difference between the social group and occupational profile of CF and NCF categories for both the crops.

6.1.2 Household size and dependency

Arithmetic mean values of household size and dependency ratio are presented in Table 6.3. Weighted Average household size²⁷ of CGP CF is 5.3 ($SD = 1.5$) while, that of CGP NCF are 6.5 ($SD = 1.8$), while for the dependency ratio²⁸, it was around 0.33 for both the groups. Similarly, one-third of family member are dependents among sample CF-NCF households. In our survey, the average dependency ratio of 0.33 is not high. Moreover, the median values of household size and dependency ratio between both the CGP groups (CF and NCF) are not significantly different from each other²⁹ (Table 6.3).

²⁷ Household size is expressed as household's total number of adult equivalents (Deaton, 1997); it was obtained by treating each individual under 15 as 0.5 adult, each individual between the ages of 15 and 65 as one adult, and each individual over 65 as 0.75 adults.

²⁸ Household dependency ratio is obtained by dividing the number of individuals in the household under 15 or above 65 years of age by the total number of individuals in the household (Bellemare, 2012).

²⁹ Using Mann-Whitney test, it was found that household size of both the CF and NCF did not significantly differ from each other ($Mdn= 5.0$ for both the categories, $U = 3858$, $Z = -.3$, $p = .77$). Similarly, household dependency ratio did not significantly differ from each other of both the CF ($Mdn = 0.33$) and NCF ($Mdn = 0.4$), U statistic = 3748, $Z = -.6$, $p = 0.27$.

The weighted average household size of onion CF were 5.6 ($SD = 2.3$) while, that of NCF are 5.9 ($SD = 2.4$). The weighted average of dependency ratio was around 0.34 ($SD = 0.2$) for both onion CF and NCF respectively for both the groups, Therefore, there is not much difference in the quantity and quality of family labour force between CF and NCF for CGP and onion households.

Table 6.3: Mean values of Household Size and dependency ratio

Particulars	CF	NCF		
		ACF	NNCF	NCF
CGP				
Household size	5.3 (2.3)	6.2 (2.6)	5.5 (3.4)	5.7 (3.1)
Household dependency ratio	0.33 (0.23)	0.40 (0.17)	0.32 (0.22)	0.35 (0.21)
Onion				
Household size	5.3 (2.3)	6.2 (2.6)	5.5 (3.4)	5.7 (3.1)
Household dependency ratio	0.33 (0.23)	0.40 (0.17)	0.32 (0.22)	0.35 (0.21)

Source: Computed from primary survey (2012-13)

Note. Figures in bracket are standard deviation (SD), NCF is a sub-total of ACF and NNCF

6.1.3 Age and Education

Age and education profile of sample growers are presented in Table 6.4. Weighted mean age of both CGP CF and NCF respondents is nearly 47 years ($SD = 11.5$). Three-fourth of the sample respondents (CF and NCF including ACF and NNCF) are young and middle-aged (i.e. 21-55 years). Moreover, proportions of farmer belonging to CF and NCF within the different age groups and for the type of schooling attended are similar (Table 6.4).

Table 6.4: Age and Education Profile of Farmers

CGP				
Particulars	CF	NCF		
	($n_1=89$)	ACF ($n_2=33$)	NNCF ($n_3=56$)	NCF ($n_2+n_3=89$)
Age (years)				
21-40	37.1	33.3	44.6	40.4
41-55	38.2	39.4	35.7	37.1
More than 55	24.7	27.3	19.6	22.5
Mean of age	46.9	48.9	44.9	46.2
(SD)	(11.2)	(11.2)	(10.9)	(11.0)
Median of age	45	47	45	45
Type of schooling attended				
Did not go to school	6.7	9.1	3.6	5.6
Primary (I- IV)	15.7	12.1	17.9	15.6
Upper primary –secondary (V-X)	50.6	57.6	51.8	53.9
Higher secondary (XI-XII)/diploma	16.9	15.2	19.6	18.0
Degree college/University	10.1	6.1	7.1	6.7
Mean years of schooling	8.4	8.0	8.5	8.3
(SD)	(4.5)	(4.3)	(4.0)	(4.1)
Median-	10	9	10	10
Onion				
Particulars	CF	NCF		
	($n_1=108$)	ACF ($n_2=48$)	NNCF ($n_3=44$)	NCF ($n_2+n_3=92$)
Age (years)				
21-40	44.4	45.8	36.4	41.3
41-55	41.7	39.6	40.9	40.2
More than 55	13.9	14.6	22.7	18.5
Mean of age	43.8	44.7	46.2	45.4
(SD)	(10.9)	(11.7)	(13.2)	(12.4)
Median of age	42.0	41.5	45.0	45
Type of schooling attended				
Did not go to school	8.3	6.1	23.3	14.1
Primary (I- IV)	22.2	26.5	11.6	19.6
Upper primary –secondary (V-X)	36.1	42.9	44.2	43.5
Higher secondary (XI-XII)/diploma	24.1	12.2	11.6	11.9
Degree college/University	9.3	12.3	9.3	10.9
Mean years of schooling	8.1	8.0	6.9	7.5
(SD)	(4.5)	(4.6)	(5.0)	(4.8)
Median	9.0	9.0	7.5	9

Source: Computed from primary survey

Note. Age and schooling distribution units are in percent and are calculated on column sums

In the case of onion, weighted mean age of CF and NCF respondents is nearly 43.6 years ($SD = 11.2$) and 45.9 years ($SD = 12.7$) respectively. Nearly 86% of CF and ACF

are young and middle-aged (i.e. 21-55 years) compared to 77% of NNCF. Thus NNCF were slightly more elderly compared to CF and ACF.

Literature suggests that education is positively associated with farmers' adoption of new technologies, market access, participation in the high value chain, and membership of farmers' organisation (Bachke, 2010; Feder, Just, & Zilberman, 1985; Foster & Rosenzweig, 1996; Narayanan, 2011; Onphanhdala, 2009). Feder et al., (1985, p. 276) mentions that formal schooling plays an important role in determining the allocative ability of farmer. Staal, Baltenweck, Waithaka, deWolff, and Njoroge (2002, p. 7) states that "more formal education is likely to increase farmer capacity for management and for utilizing information." Foster and Rosenzweig (1996) found out that primary education was an important predictor of adopting new farming technology and profitability during the time of the "Green Revolution" in India. Similarly, Onphanhdala (2009) in her study of Lao PDR, reported that education plays an important predictor for the adoption of new technologies and market access. Education of farmer is also a factor revealing its' social characteristics. For e.g., Sinha (1978, p. 39-42) observed the positive influence of education on the image of the farmer at the local level. Education adds social respectability as well as equips an educated person with greater capacity of leadership. Therefore, in the case of onion, where the company has introduced a new variety, CF was expected to be more educated compared to NCF. Which may not be the case of CGP, as both the farmer groups are using the same variety.

Years of schooling attended along with the type of schooling³⁰ attended have been taken as an indicator in the survey to gauge the farmers' education. According to CGP survey results, schooling profile was similar across CF, ACF, NNCF groups. Respondents without any formal schooling comprised of six and seven percent of CF and NCF respectively. Most of CF and NCF respondents (i.e. 78%) had formal schooling of upper primary and above (fifth standard and above). The sample farmers having higher secondary schooling³¹ and above were in a proportion of 27% of CF and 25% of NCF respondents (Table 6.4). Thus, most of them can read and write, hence can read the contract documents. This indicates that schooling does not play any role in farmers' decision to grow CGP in the contract and without a contract.

³⁰Type of schooling refers to whether farmer has attended primary or upper-primary or secondary, secondary, etc.

³¹Higher secondary schooling refers to that farmer had attended college after passing his tenth standard.

In the case of onion, median years of schooling of CF and ACF was nine years compared to 7.5 years of schooling. Similarly, 23.3% of NNCF did not go to school compared to 8% and 6% of CF and ACF sample respectively. Thus, overall NNCF were slightly more elderly and less educated. It seems more elderly farmers and less educated farmers were comfortable with growing traditional variety onion and reluctant to adopt a new variety of onion.

6.1.4 Agricultural Assets

Agricultural assets of the farmer are one of the good indicators of his financial position (Chauhan, Mundle, Mohanan, & Jadhav, 1973). Agricultural assets comprise of physical farm assets and livestock possessed³². Physical farm assets facilitate intensive cultivation of land. Almost all of the farmers (CGP and onion survey) owned some livestock and physical farm assets (Table 6.5). About physical farm assets, less than half of the CGP CF, ACF, and NNCF (43%, 49%, and 50% respectively) owned bullock carts. Around 87% of CGP CF, ACF, and NNCF owned electric motor or diesel pump for irrigation. More than half of CGP CF and ACF (58% and 55% respectively) owned either drip or sprinkler irrigation systems compared to 27% of NNCF. One of the reasons of higher availability of drip/sprinkler irrigation system in CGP CF is to the fact that 40% of them had received the financial assistance for the same from the contracting firm. Around 19% of CF and 24% of ACF owned tractor/heavy machinery compared to 9% of NNCF farmers.

The weighted average of the value of physical farm assets was around Rs. 141,400 ($SD= 209,500$) for CGP CF and Rs. 133,400 ($SD = 215,900$) for CGP NCF. As the data was positively skewed, Mann-Whitney test to check whether medians of farm assets between CF and NCF were different were used. Mann-Whitney test results indicated that CF ($Mdn = Rs. 66,700$) owned higher value of the physical farm assets compared to NCF ($Mdn = 46,200$), $U = 3451$, $Z = -1.48$, p (1 -tailed) = 0.07, $r = -.11$. The r value here denotes the effect size, which is low in this case.

³²Physical farm assets include ownership of bullock cart, electric/diesel motor, farm building, heavy agricultural machinery (plougher, rotavator, threshers, tillers, trolley, etc.), irrigation, and equipment. The valuation of open/tube wells have been excluded, as it very difficult to calculate their true value present value. Although, the author has the record of number of wells possessed by farmer, but not sure how many are functional and non-functional. Livestock include cow, bullocks, goat, sheep, horse, and poultry.

The weighted average value of livestock for CGP survey was Rs. 100,400 ($SD=75,500$) for CF and Rs. 108,400 ($SD=96,000$) NCF. A Mann-Whitney test results indicated that livestock values were not significantly different from each other between CF ($Mdn = 85,000$) and NCF ($Mdn = 80,000$), $U = 3699$, $Z = -.76$, $p = .45$, $r = -.11$. The fact that mean of farm assets and livestock was higher than the median is not surprising since some households in every village owned heavy agricultural machinery.

Table 6.5: Percentage of Farmers Owning Particular Type of Agricultural Assets

Types of assets	CF	NCF		
	($n_1=89$)	ACF ($n_2=33$)	NCF' ($n_3=56$)	NCF ($n_2+n_3=89$)
CGP				
Livestock	96	97	86	90
Physical farm assets	98	100	95	97
Electric motor/Diesel pump	88	88	86	87
Drip/sprinkler	58	55	27	37
Bullock cart	43	49	50	49
Tractors & related machinery	19	24	9	15
Onion				
Type of assets	CF	NCF		
	($n_1=108$)	ACF ($n_2=48$)	NNCF ($n_2=44$)	NCF ($n_2+n_3=92$)
Livestock	95	100	89	95
Physical farm assets	100	100	100	100
Electric motor/Diesel pump	97	100	95	97
Bullock cart	86	95	77	87
Drip/Sprinkler	30	12	5	9
Tractors & related machinery	12	19	9	14

Source: Computed from primary survey

Note. Units are in percentage and are calculated on column sums

In the case of onion, about physical farm assets, about 86% of CF, 96% of ACF, while only 77% of NNCF owned bullock carts. Almost all farmers owned electric motor or diesel pump for irrigation. Less than one-third (31%) of onion CF owned either drip or sprinkler irrigation systems compared to 12% of ACF and 5% of NNCF. One of the reasons for greater ownership of drip/sprinkler irrigation system is because JISL incentivises farmer to go in for micro-irrigation systems. Ownership of some tractor/heavy machinery was 19% within ACF compared to 12% of CF and 9% of NNCF farmers.

The weighted average value of physical farm assets was around Rs. 86,885 ($SD=157,830$, $Mdn = 29,375$) for onion CF and Rs. 95,213 ($SD = 178,810$, $Mdn = 27,215$) for onion NCF. Similarly, the weighted average value of livestock was around Rs. 115,437

(*SD* = 209,879) for CF and Rs. 118,747 (*SD* = 297,795) for NCF, whereas the median value for the same was Rs. 70,000 for both the groups. The median values of farm assets and livestock were similar among onion CF, ACF, and NNCF respectively (Table 6.6). Mann-Whitney test results confirmed that there were not significant differences in values of physical farm assets and livestock values between onion CF and NCF.

Table 6.6 shows that CF and ACF had higher agricultural assets compared to NNCF, indicating that financial position of CGP and onion CF and ACF were better off compared to NNCF.

Table 6.6: Value of Physical Farm Assets and Livestock of sample growers

Particulars		CF	NCF		
			ACF	NNCF	NCF
Physical farm assets (Rs. in thousand)					
CGP	Mean	150.2	167.2	104.7	127.9
	(<i>SD</i>)	(224.0)	(221.3)	(181.0)	(198.1)
	Median	66.7	60.2	31.4	46.2
Onion	Mean	86.9	124.4	52.8	93.0
	(<i>SD</i>)	(157.8)	(215.4)	(96.5)	(169.8)
	Median	29.4	29.1	25.8	28.5
Livestock Value (Rs. in thousand)					
CGP	Mean	102.9	118.2	86.8	98.4
	(<i>SD</i>)	(81.2)	(102.4)	(76.3)	(87.7)
	Median	85.0	90.0	72.5	80.0
Onion	Mean	126.7	150.1	71.1	120.1
	(<i>SD</i>)	(250.4)	(364.7)	(61.3)	(258.3)
	Median	70.0	70.0	61.0	70.0

Source: Computed from primary survey (2012-13)

6.1.5 Credit constraintness

The growing empirical literature suggests that in rural areas of developing countries credit constraintness have significant adverse effects on farm output (Feder, Lau, Lin, & Luo, 1990; Petrick, 2004; Sial & Carter, 1996, cited in Guirkinger & Boucher, 2008)], farm profit (Carter, 1989; Foltz, 2004; cited in Guirkinger & Boucher) and farm investment (Carter and Olinto, 2003, cited in Guirkinger & Boucher).

In most of the empirical literature, households are classified as credit constrained if they demonstrate an excess demand for credit (Guirkinger & Boucher, 2008). To identify farmers as credit constrained, the direct elicitation methodology used by Boucher, Guirkinger and Trivelli (2006) have been adopted. Farm households were classified as constrained if they demanded an excess demand for credit and did not get it. Farmers'

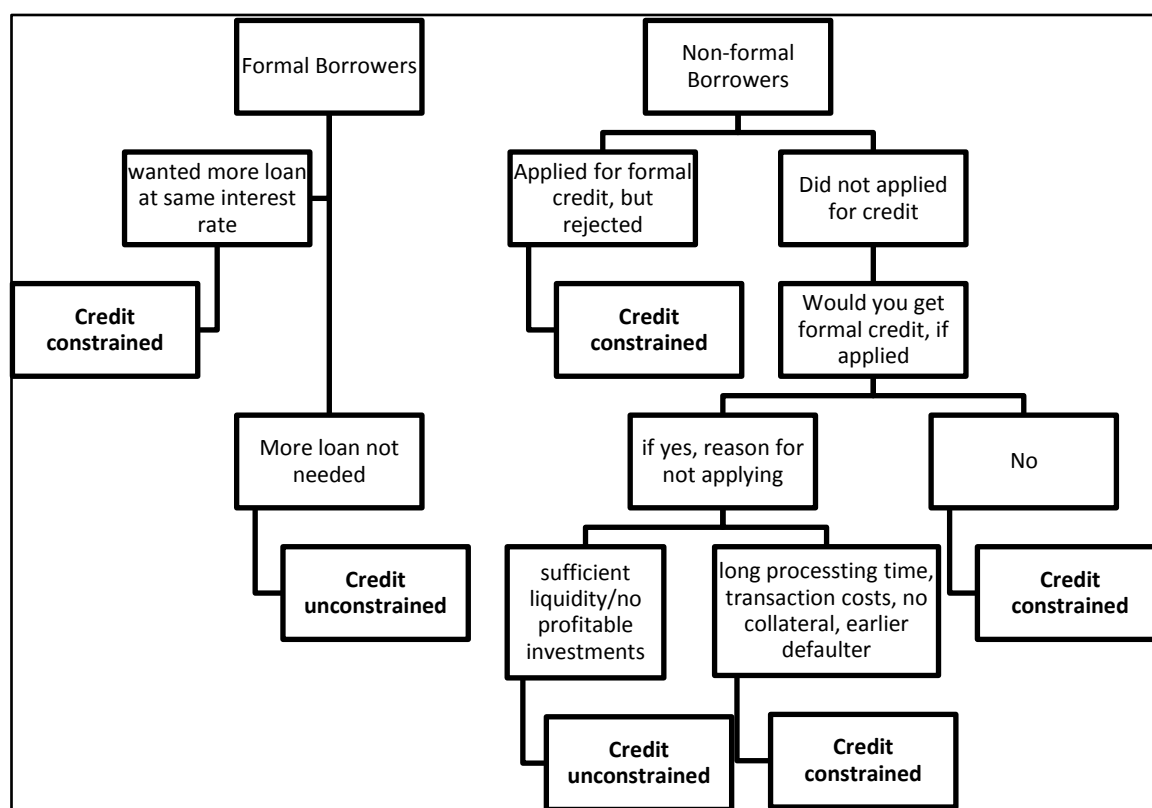
are also credit constrained if they got credit but wanted to have had more under the same terms and conditions (viz. interest rate). This kind of rationing is termed as quantity rationing. Quantity rationing is a supply side constraint and occurs when a borrower's effective demand exceeds supply (Boucher et al. 2006, p. 10). While apart from this there may be other means that may affect households' terms of access to the credit market for e.g., transaction costs associated with getting the bank loan. Banks may pass on to borrowers the transaction costs associated with screening applicants. These transaction costs may make it unprofitable for a farmer to take a loan (Guirkinger & Boucher, p. 296).

The questionnaire used to collect our data was designed to detect the quantity rationing (Appendix B). To identify whether the farmers are credit constraint or not, initially farming households were separated into formal borrowers and formal non-borrowers. Formal borrowers are referred to as those households which had taken a loan in last 12 months from either a commercial bank or cooperative credit society. There were series of questions that the farmers were asked. If the borrowing household wanted to have more amount of loan at the same interest rate, they were classified as credit constrained farming household (CCFH), if not then they were classified as credit unconstrained farming household (CUFH). Further questions that were asked to formal non-borrowers, they were asked if they had applied for credit, but application got rejected during the last five years were classified as CCFH. For non-borrowers, who had not applied for credit, were asked certain perception based questions like whether a bank/cooperative society lend to you if you applied? If the farmer says yes, then he was asked the reasons for not applying. Those that said they had sufficient liquidity or they had no profitable investments to make were classified as CCFH. If the reason for not applying is due to long processing time, paperwork, costly fees of application or he did not have collateral or had no chance of getting a loan may be due to the reason that he was a defaulter earlier, then the farmer is credit constrained. The identification process of CCFH and CUFH is also depicted in Figure 6.1, while its results are presented in Table 6.7.

In the case of CGP, it was observed that 78% of CF and ACF were CUFH compared to 68% of NCF. As CF receive crop loan of Rs. 25,000 and above hence most of them belong to CUFH. Prevalence of credit constraintness seems to be limited in the case of CGP. Boucher, Guirkinger, and Trivelli (2006) in the study on Peruvian farmers

had observed that credit constraintness become less prevalent over time. As CGP CFAs are going on for over a decade and also CF receive crop loan of Rs. 25, 000 per acre, these could be the reason for the limited prevalence of credit constraintness. In the case of onion, 66% of NCF were CCFH compared to 55% of CF households (Table 6.7). Overall CF and ACF have similar credit constraintness profile.

Figure 6.1: Farming household: Credit constrained or unconstrained



Source: primary survey

Table 6.7: Farming household: credit constrained or unconstrained

Types of assets	CGP			
	CF ($n_1=89$)	NCF		
		ACF ($n_2=33$)	NCF' ($n_3=56$)	NCF ($n_2+n_3=89$)
Credit constrained	21.3	21.2	37.5	31.5
Credit unconstrained	78.7	78.8	62.5	68.5
Particulars	Onion			
	CF ($n_1=108$)	NCF		
		ACF ($n_2=48$)	NNCF ($n_3=44$)	NCF ($n_2+n_3=92$)
Credit Constrained	55.6	57.1	76.7	66.3
Credit unconstrained	44.4	42.9	23.3	33.7

Source: Computed from primary survey

Note. Figure in percent and have been calculated on column sums

6.1.6 Proximity of the farm to paved road

For CGP survey, the weighted average distance of the CGP farms to the paved roads was in the range of 0.9 km for CF and 0.7 km for NCF. Whereas, the average distance of onions to the paved roads were around 1.4 km for both CF and NCF (Table 6.8). Thus, there is not much difference in the average distance of farm to paved roads. Also, minimum and maximum values of the distance are same. Thus in case of both the crops neither CF, who were far away, were averse to working with firm, nor did the firm had any biasedness towards them

Table 6.8: Distance of farm to paved road
(units in km)

Statistics	CGP		Onion	
	CF	NCF	CF	NCF
<i>Mean</i>	0.9	0.7	1.4	1.5
<i>SD</i>	1.1	0.9	1.6	1.7
<i>Mdn</i>	0.5	0.5	1.0	1.0
<i>Min.</i>	0.0	0.0	0.0	0.0
<i>Max.</i>	6.0	6.0	5.0	5.0

Source: Primary survey

6.2 Farm Related Characteristics

6.2.1 Type of Land Ownership

In the case of both the crops, sample farmers were mainly owner-cultivators. In the case of CGP, owner-cultivators constituted 95% of CF and NCF categories respectively, while rest were tenants and owner-cum-tenants (Table 6.9). Similarly, for onion, owner-cultivators represented 83% of CF and 88% of NCF, while rest were tenants and owner-cum-tenants. Thus, it seems that lease market was not very active in sample villages.

Table 6.9: Land ownership pattern

CGP				
Types of assets	CF	NCF		
	($n_1=89$)	ACF ($n_2=33$)	NNCF ($n_3=56$)	NCF ($n_2+n_3=89$)
Owners	95.5	90.9	96.4	94.4
Owner-cum-tenant	4.5	9.1	3.6	5.6
Tenants	0.0	0.0	0.0	0.0
Onion				
Particulars	CF	NCF		
	($n_1=108$)	ACF ($n_2=48$)	NNCF ($n_3=44$)	NCF ($n_2+n_3=92$)
Owners	83.3	89.8	86.0	88.0
Owner-cum-tenant	15.7	10.2	14.0	12.0
Tenants	0.9	0.0	0.0	0.0

Source: Computed from primary survey

Note. Figure in per cent and have been calculated on column sums

6.2.2 Size Categories

Land is an important resource base of the farmer in the production process. The economic and social progress of farmers mostly depends on the size of their operational holdings (Shah, 2013). Keeping in view the significance of land resources, it was thought essential to show the land use pattern of sampled farmers. The distribution of the sample according to the size categories of the operational holding (marginal and small: < 5.0 acres, medium: 5.0 – 9.9 acres, and large: 10 acres and above) is given in Table 6.10 and Table 6.11 for CGP and onion farmers respectively. Distribution pattern of operational holding is similar within CF and ACF categories in both the crops. This can be seen from the fact that proportion of CF and ACF belonging to marginal and small (16%), medium (33%) and large farm categories (50%) for both crops are almost similar. Whereas proportion of NNCF belonging to marginal and small were 41%, medium were 46%, and large were 13% in case of CGP, while for onion it was 34%, 41% and 25% respectively. Thus, proportion of small farmers is higher in NNCF or overall in NCF, compared to CF. Overall for both the crops, NNCF have lower holdings within NCF compared to ACF.

Table 6.12 presents preference of contracts based on holding size categories. Two-thirds of the small CGP farmers had chosen to grow CGP without a contract, while almost two-third of the large category farmers had chosen to grow CGP with a contract

in 2012. Similarly, 43% and 60% of small and large category farmers within the sample had chosen to grow onion with a contract in 2011. For both the crops, descriptive statistics show that operational holding is higher in the case of CF compared to NCF, and this claim is supported by Mann-Whitney test results³³.

Table 6.10: Size of the operational holdings of CGP farmers

Size of the holding (acres)	CF ($n_1=89$)	NCF		
		ACF ($n_2=33$)	NNCF ($n_3=56$)	NCF ($n_2+n_3=89$)
Marginal and small (0- 4.9)	15.7	15.2	41.1	31.5
Semi-medium (5.0- 9.9)	34.8	33.3	46.4	41.6
Large (10.0 and above)	49.5	51.5	12.5	26.9
<i>Mean of operational holding</i>	11.0	11.2	6.0	7.9
<i>(SD)</i>	(7.5)	(7.9)	(5.5)	(6.9)
<i>Median</i>	9.0	10.0	5.0	5.8

Source: Computed from primary survey

Note. Units in per cent and have been calculated on column sums.

Table 6.11: Size of the Operational Holdings of Onion Farmers

Size of the holding (acres)	CF ($n_1=108$)	NCF		
		ACF ($n_2=49$)	NNCF ($n_3=43$)	NCF ($n_2+n_3=92$)
Marginal and small (0- 4.9)	16.7	18.8	34.1	26.1
Semi-medium (5.0- 9.9)	32.4	27.1	40.9	33.7
Large (10.0 and above)	50.9	54.2	25.0	40.2
<i>Mean of Operational holding</i>	11.0	11.9	8.1	10.1
<i>(SD)</i>	(7.1)	(7.9)	(7.6)	(7.9)
<i>Median</i>	10.0	10.0	6.0	7.5

Source: Computed from primary survey

Note. Units in per cent and have been calculated on column sums

³³ Visualization of histogram and the results of K-S test were significant ($p < 0.05$) for operational holdings for both the crop, indicated that data was not normally distributed. Hence, non-parametric mann-whitney test was used to check whether median values are significantly different from each other. For CGP, Mann-Whitney test results indicated that holding size (acres) were significantly different for CF ($Mdn = 9$) and NCF ($Mdn = 5.8$), $U = 2262.5$, $Z = -3.32$, $p = 0.00$, $r = 0.25$. For onion, Mann-Whitney test results indicated that holding size (acres) were significantly different for CF ($Mdn = 10$) and NCF ($Mdn = 7.5$), $U = 4300$, $Z = -1.64$, p (1-tail) = 0.05. However, the effect size is small, as $r = -0.12$.

Table 6.12: Preference of contracts based on holding size

Farm size categories (acres)	CF	NCF	Total
CGP			
Marginal and small (0.0 - 4.9)	33.3	66.6	100.0 (<i>n</i> =42)
Medium (5.0 - 9.9)	45.6	54.4	100.0 (<i>n</i> =68)
Large (10.0 and above)	64.7	35.3	100.0 (<i>n</i> =68)
Onion			
Marginal and small (0.0 - 4.9)	42.9	57.1	100.0 (<i>n</i> =42)
Medium (5.0 - 9.9)	53.0	47.0	100.0 (<i>n</i> =66)
Large (10.0 and above)	59.8	40.2	100.0 (<i>n</i> =92)

Source: Computed from primary survey (2012-13)

Note. Figure in per cent and have been calculated on row sums.

6.2.2 Sources of irrigation

Most of the CGP, CF and NCF households (97% and 94% respectively) had some source of irrigation on their holding. Similarly, all the onion farm households had some source of irrigation on their holding. Open well was the source of irrigation for almost all the farmers (of both the crops) who had access to irrigation. In the case of CGP, apart from an open well as a source of irrigation, 14% of CF, 21% of ACF, and 18% of NNCF owned at least one tube-well. In the case of onion, 49% of CF, 39% of ACF, and 30% of NNCF owned at least one tube-well.

For CGP, the average percentage of irrigated land to operational landholding for the CF is 66%, which is 9% lower than NCF. For the onion, it was 89% for both CF and NCF (Table 6.13). For CGP, the percentage of irrigated land to operation landholding was higher for the sample in Satara compared to Pune.

Table 6.13: Average percentage of irrigated land to operation landholding

Crop	CF	NCF		Sub-total
		ACF	NNCF	
CGP	66	74	76	75
Onion	89	88	89	89

Source: primary survey

6.2.3 Characteristics of operational holding

For CGP and onion, the average of gross irrigated area (GIA), gross cropped area (GCA), net sown area (NSA), and cropping intensity was nearly same for CF and NCF

(Table 6.14 and Table 6.16). However, in the case of CGP, the average GIA of CF was 11.2 acres, for ACF was 13.7 acres, and NNCF was 8.7 acres. Similarly, the average GCA of CF was 11.7 acres, for ACF was 14.4 acres and NNCF was 8.7 acres. The average NSA of CF was 6.3 acres, for ACF was 7.6 acres, and NNCF was 4.9 acres. Cropping intensity of CF was 188%, for ACF was 201%, and NNCF was 182% (Table 6.14). Similarly, in the case of onion, average GIA, GCA, and NSA was highest in the case of ACF, followed by CF and then NNCF (Table 6.16). However, the cropping intensity of onion farmers CF was 174%, for ACF was 181%, and NCF was 182% (Table 6.16). Thus, for both crops, overall, the intensity of cultivation was highest in the case of ACF followed by CF and NNCF.

Table 6.14: Selected indicators of land-use pattern of holdings of CGP farmers

Particulars (acres)		CF	NCF		Subtotal
			ACF	NNCF	
Gross irrigated area	Mean	11.2	13.7	8.7	10.6
	(SD)	8.4	11.7	10.4	11.1
	Median	9.3	10.0	6.0	7.5
Gross cropped area	Mean	11.7	14.4	8.9	11.0
	(SD)	8.5	11.7	10.6	11.3
	Median	9.6	10.0	6.4	8.0
Net sown area	Mean	6.3	7.6	4.9	5.9
	(SD)	4.4	6.4	5.5	6.0
	Median	5.0	6.0	3.5	4.5
Cropping intensity (percent)	Mean	187.7	200.9	181.6	188.8
	(SD)	34.1	59.2	30.9	44.3
	Median	194.7	197.4	187.7	188.9

Source: Computed from primary survey (2012-13)

Table 6.15: Mann-Whitney Test statistics for selected indicators of land use pattern, CGP

Particular	Contracting Status	Mean Rank	<i>U</i>	<i>p</i> (1-tail)	<i>r</i>
Gross irrigated area	CF	95.77	3403	.05	.12
	NCF	83.23			
Gross Cropped Area	CF	96.62	3327	.03	.14
	NCF	82.38			
Net Sown Area	CF	96.57	3331	.03	.14
	NCF	82.43			
Cropping Intensity	CF	91.46	3787	.31	.04
	NCF	87.54			

Source: computed from primary survey (2012-13)

Note. *U*: Mann-Whitney test value; *p* (1-tail) value <.05 is statistically significant and <.01 is highly statistically significant; *r*: effect size

As these variables did not follow normal distribution, Mann-Whitney tests were used to verify whether they differ across CF-NCF groups.

Table 6.15 and 6.17 presents the Mann-Whitney Test statistics for GIA, GCA, NSA, and cropping intensity for CGP and onion crop respectively. The third column of Tables 6.15 and 6.17 provides us the mean ranks³⁴ of the variable group wise. Overall, medians of GIA, GCA, and NSA were significantly higher in the case of CGP CF compared to NCF. However, cropping intensity was not significantly different from each other. While for onion, Mann-Whitney test results indicated that except NSA, all other indicators (i.e., GIA, GCA, and cropping intensity) were significantly not different between CF and NCF.

Table 6.16: Descriptive statistics of selected indicators of land-use pattern, onion

Particulars (acres)			CF		NCF	
				ACF	NNCF	Subtotal
Gross irrigated area	Mean	17.3	19.6	13.2	17.0	
	(SD)	(12.2)	(14.4)	(12.8)	(13.0)	
	Median	14.3	15.0	9.1	12.9	
Gross cropped area	Mean	18.0	20.1	13.5	17.6	
	(SD)	12.0	14.1	13.2	13.0	
	Median	15.6	18.0	10.0	15.0	
Net sown area	Mean	10.4	11.1	7.6	10.0	
	(SD)	6.7	7.5	7.3	7.1	
	Median	9.0	9.0	5.8	8.0	
Cropping intensity (percent)	Mean	173.9	180.1	182.9	177.4	
	(SD)	31.2	24.0	42.8	32.6	
	Median	180.9	187.5	188.8	185.0	

Source: Computed from primary survey

Table 6.17: Mann-Whitney Test statistics of selected indicators of land use pattern, onion

³⁴ Mann-Whitney test relies on scores being ranked from lowest to highest; therefore, the group with the lowest mean rank is the group with the greatest number of lower scores in it and vice-versa. This is helpful in interpreting the results.

Particular	Contracting status	Mean Rank	<i>U</i>	<i>p</i> (1-tail)	<i>r</i>
Gross irrigated area	CF	104.72	4512	0.13	-0.08
	NCF	95.54			
Gross Cropped Area	CF	105.45	4434	0.10	-0.09
	NCF	94.69			
Net Sown Area	CF	106.92	4275	0.04	-0.12
	NCF	92.97			
Cropping Intensity	CF	105.53	4506	0.13	-0.08
	NCF	96.22			

Source: Computed from primary survey (2012-13)

Note. *p* (1-tail) value <.05 is statistically significant at 5% significance level; *r*: effect size

6.2.4 Farming and Crop experience

It is important to understand the role farming and crop experience plays in understanding participation aspects of contract farming. If younger farmers or farmers with limited farming or crop experience adopt new variety of crops that is a sign of inclusiveness aspect of contract farming, as it helps farmer's gain new skills and knowledge. Moreover, according to Staal et al. (2002), longer farming experience predisposes farmer to better farming techniques through learning by doing. Thus, whether only farmers with longer farming experience participate in onion and CGP contract farming is examined below.

Category-wise distribution of farming and crop experience of the CGP farmers as per the CF, ACF, and NNCF groups has been presented in Table 6.18. The average farming experience of the CGP CF, ACF, and NNCF was 23, 26, 21 years respectively. Around half of the farmers belonging to CF, ACF, and NNCF, had farming experience in the range of 11-25 years. While 23% of CF and NNCF had farm experience of less than ten years. Within ACF farmers, 6% had farm experience of less than 10 years and while 43% have been farming for more than 25 years. Therefore, it seems more experienced farmers are the ones who have left CF. This finding is also supported when the average years of experience of respondents of growing potato (inclusive of both table and CGP variety), presented in Table 6.18 is seen. Average potato crop experience of CF, ACF, and NNCF was 12, 19, 14 years respectively. Around 55% of the ACF had more than 16 years of experience of growing potato (inclusive of both table and CGP variety), while for CF it was only 19%. Around 44% of CF had experience of less than eight years of growing potato, compared to 24% in ACF and NNCF respectively. Therefore, the

farmers who are less experienced in growing potato are associated with growing CGP under contract.

Table 6.19 shows that 64% of less experienced potato growers (i.e., grew potato for eight years or less) grew CGP under contract in 2012. Similarly, more than two-third of experienced potato growers (i.e., grown potato for more than 16 years) within the total sample grew CGP without a contract. Years of experience of growing potato was significantly higher for NCF ($Mdn = 13$) compared to CF ($Mdn = 10$), $U = 2822$, $p < .001$, $r = -.25$.

Table 6.18: Farming and Crop Experience, CGP

Particulars	CF	NCF		
	($n_1=89$)	ACF ($n_2=33$)	NCF' ($n_3=56$)	NCF [(n_2+n_3)=89]
Farm experience (years)				
0 – 10	23.6	6.1	23.2	16.9
11 – 25	46.1	51.5	50.0	50.4
More than 25	30.3	42.4	26.8	32.6
Mean	3.0	26.2	20.5	22.6
(SD)	(12.5)	(11.5)	(11.1)	(11.6)
Median	20	22	17	20
Potato crop (including CGP) experience (years)				
0 – 8	43.8	24.2	25.0	24.7
9-16	37.1	21.2	42.9	34.8
More than 16	19.1	54.5	32.1	40.4
Mean	11.7	19.3	14.4	16.2
(SD)	(9.3)	(11.7)	(9.2)	(10.4)
Median	10	19	12	13

Source: Computed from primary survey (2012-13)

Note. Figures in per cent and have been calculated on column sums

Table 6.19: Farming and crop experience, CGP (Outflow Table)

Particulars	CF	NCF	Total
Farm experience (years)			
0 – 10	58.3	41.7	100.0 ($n=36$)
11-25	47.7	52.3	100.0 ($n=86$)
More than 25	48.2	51.8	100.0 ($n=56$)
Weighted Mean	23.2	24.3	
(SD)	(12.7)	(11.7)	

Potato crop experience (years)			
0 – 8	63.9	36.1	100.0 (<i>n</i> =61)
9-16	51.6	48.4	100.0 (<i>n</i> =64)
More than 16	32.1	67.1	100.0 (<i>n</i> =53)
Weighted mean	11.8	18.8	
(<i>SD</i>)	(7.6)	(10.1)	

Source: Primary survey (2012-13); *Note.* Units are in percent and have been calculated on row sums; '*n*' indicates sample belonging to the respective row attribute.

Percentage distribution of farming and crop experience of onion growers as per the CF, ACF, and NNCF groups has been presented in Table 6.20. The average farming experience of CF, ACF, and NNCF was 25, 24, 27 years respectively. Around half of the onion CF have farming experience in the range of 16-30 years. The percentage of farmers having farming experience of more than 30 years were lower in CF (i.e., 25%) compared to NNCF (i.e., 39%). About 37% of the NNCF have farming experience of more than 30 years compared to 25% of CF. Therefore, it seems more experienced farmers are reluctant to grow company's onion in the contract. This finding is also supported when the years of experience of respondents of growing onion, presented in Table 6.20 is seen. Average onion crop experience of CF and ACF was 14.9 years compared to 18.2 years of NNCF. While the weighted average of onion crop experience of CF and NCF was 14.9 and 16.4 years respectively. Similarly, median onion crop experience of NNCF was 16 years compared to 11.5 years of CF. One-third of the CF had experience of growing onion of less than eight years compared to 21% of NNCF. Similarly, 62% of less experienced growers (i.e., grown onion for less than eight years) grew onion without a contract.

Overall from the both crops survey, it seems less experienced farmers are more likely to be associated with the contract. As per the discussion with farmers, the reason being they have less crop and market knowledge, and the production and price risks are higher in the non-contract production of these crops. Hence growing crop under contract is associated to be less risky as firm assist in production, by enhancing farmers' capabilities like the adoption of irrigation systems and good agricultural practices. With MGP, farmers' price risks are covered.

Table 6.20: Farming and Crop Experience (years) of Onion Farmers

Particulars	CF	NCF		
	($n_1=108$)	ACF ($n_2=48$)	NNCF ($n_3=44$)	NCF ($n_2+n_3=92$)
Farm experience (years)				
0 – 15	25.0	35.4	25.0	30.4
16 - 30	49.1	37.5	36.4	37.0
More than 30	25.9	27.1	38.6	32.6
Mean	24.8	23.7	27.0	25.2
(SD)	12.2	11.8	14.2	13.0
Median	25.0	24.0	25.0	25.0
Onion crop experience (years)				
0 – 8	34.3	29.2	20.5	25.0
9-16	25.9	35.4	31.8	33.7
More than 16	39.8	35.4	47.7	41.3
Mean	14.9	14.8	18.2	16.4
(SD)	10.5	9.4	11.9	10.7
Median	11.5	12.0	16.0	14.0

Source: Computed from primary survey

Note. Figures in per cent and have been calculated on column sums

Table 6.21: Farming and crop experience, Onion (Outflow Table)

Particulars	CF	NCF	Total
Farm experience (years)			
0 – 10	49.1	50.9	100.0 ($n=55$)
11-25	60.9	39.1	100.0 ($n=87$)
More than 25	48.3	51.7	100.0 ($n=58$)
Onion crop experience (years)			
0 – 8	61.7	38.3	100.0 ($n=60$)
9-16	47.5	52.5	100.0 ($n=59$)
More than 16	53.1	46.9	100.0 ($n=87$)

Source: Computed from primary survey

Note. Units are in percent and have been calculated on row sums; 'n' indicates sample belonging to the respective row attribute.

Table 6.22: Mann-Whitney test statistics for farm and onion crop experience

Particulars	Mann-Whitney U	Z	p (1-tail)	r
Farming experience	4934	-0.08	0.47	-0.01
Onion crop experience	4512	-1.12	0.13	-0.08

Source: Computed from primary survey

Note. r : effect size

6.2.5 Cropping Pattern

The cropping pattern seems to be similar across the CGP and onion sample growers. Within the total CGP sample (CF, ACF, and NNCF), on an average almost half of the GCA was allotted to foodgrains (rice, wheat, coarse cereals, and pulses) while rest half to cash crops (Table 6.23). It is observed that CGP is the dominant crop for sample farmers in Kharif season, which was followed by jowar in Rabi season. About 61% of the sample were growing cash crop other than CGP.

The weighted average percentage of CGP area of the total Kharif area was 66.9% and 69.4% for CF and NCF respectively. In Pune, on an average, more than three-fourth of the total Kharif area of CF, ACF, and NNCF consisted of CGP. Whereas in Satara, 50%, 71% and 56% of the total Kharif area of CF, ACF and NNCF respectively, was allotted to CGP (Table 6.25).

The weighted average area under CGP was 3.9 acres for CF and 3.6 acres for NCF. In the case of Pune, the average CGP acreage was 5.4 acres for CF, 6 acres for ACF' and 2 acres for NNCF. Similarly, in Satara, the average CGP acreage was 2.5 acres for CF, 2.6 acres for ACF and 1.7 acres for NNCF

Table 6.24). One of the important reasons for higher CGP acreage is that CGP cultivation in Pune started extensively from 2002-03 compared to 2006-07 in Satara. Also, the environmental climate and market conditions for CGP cultivation are more favorable in Pune CGP cultivating areas compared to Satara. In Pune, there are many players apart from Pepsico which purchase CGP through many agents. Another important point to be noted is that CGP acreage is higher for CF and ACF, while it is very low for NNCF. Thus, those farmers who have larger acreage under CGP are either CF or ACF. Larger CGP acreage means larger investment and risks. Thus these farmers grow CGP under contract to address the production and market risks.

Table 6.23: Percentage distribution of overall acreage of GCA, CGP farmers

Particulars	CF	NCF		Sub-total
		ACF	NNCF	
CGP				
Food crops	49	49	54	52
Cash crops	51	51	46	48
Onion				
Food crops	20	24	21	23
Cash crops	80	76	79	77

Source: Computed from primary survey

Table 6.24: Average CGP acreage (acres) district wise

District	CF	NCF		
		ACF	NNCF	Sub-total
Pune	5.4	6.0	2.0	4.2
Satara	2.5	2.6	1.7	1.9
Total	3.8	5.0	1.8	3.0

Source: Computed from primary survey (2012-13)

Table 6.25: Percentage share of CGP acreage out of kharif area and GCA, CGP

Particulars	District	CF	NCF		
			ACF	NNCF	Sub-total
CGP area of kharif area	Pune	78	76	76	76
	Satara	56	71	50	54
	Total	66	75	59	65
CGP area out of GCA	Pune	40	39	39	39
	Satara	28	33	23	25
	Total	34	37	29	32

Source: Computed from primary survey (2012-13)

Table 6.26: Percentage share of jowar acreage out of Rabi area and GCA, CGP

Particulars	District	CF	NCF		
			ACF	NNCF	Sub-total
Jowar area out of total rabi area	Pune	87	77	90	83
	Satara	76	63	66	66
	Total	81	73	75	74
Jowar area out of GCA	Pune	42	37	45	41
	Satara	34	37	35	35
	Total	37	37	38	38

Source: Computed from primary survey (2012-13)

The other crops grown by CGP growers during the kharif season are rice, corn, bajra, groundnut, vegetables, and pulses. There were only four farmers from the sample within Pune and none from Satara district who were also growing table variety potato. The share of Jowar in Rabi season was 81% for CF, 73% for ACF and 75% for NNCF. The share of jowar in GCA was around 38% for both CF and NCF (

Table 6.26). The other crops grown in Rabi are wheat, red onion, corn, and vegetables. There were no perennial crops grown by Pune sample growers. However there were quite a few growers in Satara district growing sugarcane and ginger.

In the case of onion, cotton is a dominant crop grown, comprising of 41% of GCA followed by onion with 22% of GCA. Cropping pattern seems to be similar across sample growers (Table 6.27). Within the total sample, on an average 21% of the GCA

was allotted to food crops (rice, wheat, corn, coarse cereals, and pulses) while rest to cash crops. The average percentage of onion area of total Rabi area was 37% in case of CF and NNCF and 26% for ACF. The average Kharif and Rabi acreage for onion farmers is presented in Table 6.28. The Rabi onion acreage is higher compared to Kharif onion acreage. The average Rabi onion acreage was 1.9 acres, 1.5 acres, and 1.1 acres for CF, ACF, and NNCF respectively Table 6.28.

Table 6.27: Percentage distribution of overall acreage, Onion farmers

Particulars	CF	NCF		Sub-total
		ACF	NNCF	
Food crops out of GCA	19.6	24.1	21.4	22.8
Cash crops out of GCA	80.4	75.9	78.6	77.2
Cotton out of GCA	40.7	42.9	38.7	40.9
Onion out of GCA	22.2	18.4	25.7	21.9
Onion out of Rabi	37.0	26.0	36.5	31.0

Source: Computed from primary survey

Note: percentage is for the whole reference year

Table 6.28: Average onion acreage (acres) season-wise, 2011-12

Season	CF	NCF		Sub-total
		ACF	NNCF	
Kharif	1.4	1.5	1.1	1.3
Rabi	1.9	1.6	1.5	1.6

Source: Computed from primary survey

The other crops grown by sample growers during Kharif season are bajra, groundnut, mung (bean), corn, and vegetables. The other crops grown in Rabi are wheat, groundnut, corn, and vegetables. There were few famers who had orchard or sugarcane Overall, there were no major differences in cropping pattern across sample. However, intensity of Rabi onion cultivation was higher among CF compared to NCF³⁵.

6.3 Determinants of contract farming participation – Logit regression

6.3.1 Analysis Plan

The determinants of participation in the contract farming (compared to the non-contract which is also referred as without contract) using the logit regression model for both the crops are modelled separately. The strategy was adopted whereby initially, variables were identified with a careful thought (literature review and field observations) that would influence the probability of farmers' participation in contract farming. This

³⁵ Mann-Whitney test results indicated that onion Rabi acreage (acres) were significantly different for CF ($Mdn = 1.50$) and NCF ($Mdn = 1.12$), $U = 4141$, $Z = -2.04$, $p = 0.04$.

involved running a preliminary logit model whereby all the intuitively relevant variables regardless of their statistical significance were included. However, the problem with this strategy is that the resulting model may be over fit producing unstable results, i.e., large estimated co-efficient and standard errors (Hosmer & Lemeshow, 2000). As suggested by Hosmer and Lemeshow, it is important to review all variables added to model critically before a decision is reached regarding the final model. The strategies suggested in Hosmer and Lemeshow for the variable selection for the participation model were adopted. The univariable analysis was conducted, whereby contracting status was dependent variable and each independent variable in the preliminary model was explanatory variable of the logit model. Any variable whose univariable test has a p -value < 0.25 was included in the final model. This strategy allows the suspected variables to become candidates for inclusion in the model (p. 95). Thus, after identifying the significant variables and also those variables which are important from a theoretical perspective, the final logit model was run. The general Logit model takes the form

$$A_i = F(B_i, H_i, R_i) + \varepsilon_i \dots \dots \dots (1)$$

In the above equation (1), A_i is a binary variable that shows the farmers' choice of contract farming = 1, and without contract or non-contract = 0. Where B_i, H_i, R_i are the vector of the regressors viz. farmer characteristics, household characteristics, and farm-related characteristics, respectively. The regressors of the participation model and the empirical results have been explained in the section 6.3.2.

The parameters estimated in this equation have been estimated by the maximum likelihood method using the IBM SPSS 20.0. As suggested in Field (2009), after the final model selection, the assumption of linearity of continuous predictors and no multicollinearity among all predictors were checked. For testing the assumption of no multicollinearity, statistics such as the tolerance and variance inflation factor (VIF) were obtained by simply running a linear regression analysis using the same outcome and predictors. Linearity assumption was checked by running the final logit regression, whereby also including predictors that are the interaction between each continuous predictor and the log of itself.

6.3.2 Description of variables

The dependant variable a binary variable that shows the farmers' contracting status (contract farming =1, non-contract = 0) and the regressors in participation equation are

chosen through the literature review and field observations. The concepts of farmers', households and farm characteristics as explanatory variables, which are discussed in the following subsections. The participation model developed explains the relationship between contract farming participation and farmers', household's and farm characteristics. Overall, the description of variable and their anticipated relationship with contract farming participation is presented in Table 6.29

6.3.2.1 Farmer characteristics

- a) Farmers age, farming and crop experience: These variables have ambiguous expectations, on the one hand, it is expected that as the farmer ages or experienced, he/she is more reluctant to change his/her choice of market channel. Therefore if the farmer has been growing the traditional variety of crop and selling to the traditional market channel for a long period, he/she is reluctant to take up a new variety cultivation under a new marketing channel. On the other hand, as the farmer ages, he/she has more experience thus, being able to adapt to more demanding market conditions (Hernández, 2009).
- b) Years of schooling: This variable is expected to positively associate contract farming participation. As education increases, farmers can learn and shall be willing to adopt new technologies (Feder et al., 1985; Hernández, 2009).

6.3.2.2 Household characteristics

- c) Household size: According to Hernández, the more available household labor will increase the probability of participating in presumably more labor demanding market channels. As contract farming demands good quality produce which in turn requires greater attention of farmers. Thus, household size has positive association with the probability of participation in CFAs.
- d) Access to non-farm income/own livestock: According to Feder et al. (1985, p. 278), non-farm income helps to overcome working capital constraint or funding any fixed investment. Thus, this variable is likely to have positive influence on contract farming participation, as contract farming may encourage farmers to adopt modern technologies, which may require some investment.

Similarly, livestock ownership is related to access to subsidiary income which is likely to overcome working capital constraints of farming.

- e) House type: House owned by farmer could be kucha i.e., mud or cow dung etc. or that which is made of stones, bricks and with cement, Pucca house indicate that the household is affluent. With higher wealth, there is a reduction of degree of risk aversion. As CGP cultivation, involves higher investments, thus, it is expected to have positive association with contract farming participation.
- f) Credit constraint: Credit constraintness is likely to restrict the farm investments as well as ability to grow cash crop as they entail high working capital. As CGP CF receive crop loan of Rs. 25, 000 and above hence CUFH are likely to be under contract. Also, cost of cultivation is lower in growing table variety onion compared to JISL onion. Therefore, CUFH are likely to be under contract

6.3.2.3 Farm related characteristics

- g) Operational holding: Operational holding denotes production resource endowment of the farmer. Farmers with large landholding would be willing to grow cash crops in higher intensity. Therefore, this variable to have the positive influence on the probability of participation in contract farming. The categorical variable for operational landholding, i.e., distribution of the sample is done in three size categories (marginal and small: < 5.0 acres, medium: 5.0 – 9.9 acres, and large: 10 acres and above) have been included.
- h) GCA and reference crop area: GCA and reference crop acreage denotes intensity of overall and reference crop cultivation respectively. These variable to have positive influence in probability of participation in contract farming. As higher the CGP and onion cultivation, higher are the investments, thus farmers shall like to reduce their risk coverage by participating in contact.
- i) Agriculture assets: Greater agriculture assets would mean greater agriculture capacities to grow cash crops and for intensive cultivation, which would positively influence probability of participation in contract farming. As this variable was not normally distributed, the variables were sub-divided into three

categories for CGP viz. less than Rs. 30000; Rs. 30,001 - 1,00,000; and above Rs. 1,00,000; for onion viz. less than or equal to Rs. 25000; Rs. 25,001 - 50,000; and above Rs. 50,000

- j) Farm to road distance: This variable has ambiguous expectations, with the farm being further from the road, leads to higher costs of the farmer on getting inputs and selling the output. Thus, the further farm is away from the road, more likely he is to join contract farming, as firm provides inputs and make procurement arrangements from the farm. Another argument is that further, the farm is away from the road, the contracting firm may not be keen to initiate a contract due to additional transaction cost expenditure.

Table 6.29: Description of explanatory variables of participation model

Variables	Variable Description	Anticipated sign	
Farmer characteristics			
Age (years)	21-40 = 0RC 41-55 = 1 >55 = 2	+/-	
Years of schooling	No formal schooling/primary = 0 RC Secondary schooling = 1 Higher secondary schooling =2	+/-	
Farm experience (years)	CGP 0-10 = 0RC 11-25 = 1 >25 = 2	Onion 0-15 = 0RC 16-30 = 1 >30 = 2	-
Crop experience	0-8 = 0RC 9-16 = 1 >16 = 2	-	
Household characteristics			
Household size	Continuous		
Access to non-farmer income	No = 0 RC 1 = yes	-	
Owens Livestock	No = 0 RC 1 = yes	+/-	
House type	Kucha= 0 RC Pucca = 1	+/-	
Credit constrained	No = 0 RC 1 = yes	+	
Farm related characteristics			

Operational holding*	Marginal & small = 0 RC Medium = 1 Large = 2	+/-	
GCA (acres)	Continuous	+	
Reference crop (acres)	Continuous	+	
Farm to road distance(km)	Continuous	+	
Agricultural assets (Rs.)	CGP <=30,000 = 0 RC 30001–100000=1 >100000 =2	Onion <=25000 = 0 RC 25001– 50000=1 >50000=2	+

Note: * Marginal & small = <5acres; medium 5.0 = 9.9 acres; large = >=10 acres.

RC = reference category

6.3.3 Results

The Preliminary results of the estimated logit model for CGP and onion are presented in Table 6.30 and Table 6.32. As noted in Swain (2012, p. 178), that though signs and significance of the coefficient are simplest way to interpret Logit model, inferring odd ratio (along with its confidence interval) are important. Hosmer and Lemeshow (2000) point out:

“Estimated coefficients for the independent variables represent the slope (i.e., the rate of change) of a function of the dependent variable per unit of change in the independent variable. Thus, interpretation involves two issues: determining the functional relationship between the dependent and independent variable, and appropriately defining unit of change in the independent variable (p. 47). While odd ratio is a measure of association, as it approximates how much more likely (or unlikely) is the outcome to be present among those with $x = 1$ than those among $x = 0$ ” (p. 50).

A positive co-efficient means that odds of observing a higher participation in contract farming increase with a higher value of the independent variable. While a negative co-efficient has exponentiated value between 0 and 1 which decreased the odds (Swain, 2012).

Of the 14 explanatory variables in preliminary CGP participation model (Logit), five variables viz. crop experience, livestock ownership, operational holding, GCA, and

CGP acreage were found to be statistically significant³⁶. Model chi-square test³⁷ was found to be significant and Hosmer and Lemeshow (H-L) test³⁸ not significant which indicates that model has adequate fit. Also overall model had predictive accuracy of 73%, which is considered to be good.

Table 6.30: Preliminary CGP participation model (Logit)

Variables in the Equation			B	S.E.	Wald	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Farmer Characteristics	Age (years)	41_55	.50	.47	1.12	.29	1.65	.65	4.17
		>55	.54	.58	.87	.35	1.71	.55	5.33
	Schooling	secondary	-.64	.52	1.54	.21	0.53	.19	1.45
		higher secondary	-.56	.63	.80	.37	0.57	.17	1.96
	Crop experience (years)	9-16***	-.82	.46	3.19	.07	0.44	.18	1.08
		>16*	-2.51	.64	15.24	.00	0.08	.02	.29
	Farm experience (years)	11-25	-.11	.52	.05	.82	0.89	.32	2.45
		>25	.03	.71	.00	.97	1.03	.25	4.13
Household characteristics	HH Size (units)		-.11	.08	1.76	.18	0.90	.76	1.05
	Access to non-farm income		-.53	.44	1.43	.23	.59	.25	1.40
	Owns livestock***		1.25	.77	2.65	.10	3.51	.77	15.90
	Credit constraint		.14	.44	.09	.76	1.15	.48	2.72
	House type (Pucca)		.34	.46	.54	.46	1.40	.57	3.43
Farm related Characteristics	Operational holding	Medium**	1.11	.56	3.97	.05	3.03	1.02	8.99
		Large*	1.85	.64	8.36	.00	6.39	1.82	22.45
	GCA (acres)**		-.08	.04	4.51	.03	.93	.87	.99

³⁶ Statistical significance is based on Wald statistic. In logit regression, Wald statistic has a special distribution known as the chi-square distribution. Like the *t*-test in linear regression, the Wald statistic tells us whether the β coefficient for that predictor is significantly different from zero. Wald statistic = $\beta / S.E.$ β . If the p-value of Wald statistic is less than 0.05, then that coefficient is significantly different from zero (Field, 2009, p. 287).

³⁷ It is statistical test of the null hypothesis that all the predictor coefficients are zero. It is equivalent to the overall *F* test in linear regression.

³⁸ Hosmer and Lemeshow³⁸ (H-L) test of goodness of fit is similar to a Chi Square test, and indicates the extent to which the model provides better fit than a null model with no predictors, or, in a different interpretation, how well the model fits the data.

istics	CGP acreage (acres)*		.30	.10	8.67	.00	1.34	1.10	1.64
	Farm to road distance(km)		.18	.18	.98	.32	1.19	.84	1.70
	Agricultural assets	30,001 -10,000	.09	.45	.04	.84	1.10	.45	2.68
>1,00,000		-.01	.55	.00	.99	.99	.34	2.90	
	Constant		-.63	1.11	.32	.57	.53		
Hosmer and Lemeshow test : 4.0 (.86)					Chi-square value: 49.0 (.00)				
-2 Log likelihood : 197.8					Total percent correct classification: 73%				

Note: *, **, and *** indicate variables are significant at 1, 5, and 10% respectively; N = 178, CF =89, NCF = 89

After initially running the preliminary model, the final modal was ran with only ten predictors excluding the variables in the Table 6.30 that have high p-values and also on the basis of univariable analysis. The final CGP participation model is presented in Table 6.31.

Table 6.31: Final CGP participation model (Logit)

Variables in the Equation			B	S.E.	Wald	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Farmer Characteristics	Age (years)	41_55	.52	.44	1.41	.23	1.68	.71	3.94
		>55	.59	.51	1.38	.24	1.81	.67	4.88
	Schooling	secondary	-.68	.49	1.88	.17	.51	.19	1.34
		higher secondary	-.64	.57	1.28	.26	.53	.17	1.60
	Crop experience (years)	9-16***	-.91	.43	4.48	.03	.40	.17	.93
>16*		-2.58	.58	19.77	.00	.08	.02	.24	
Household characteristics	HH Size (units)		-.11	.08	1.75	.19	.90	.77	1.05
	Access to non-farm income		-.50	.42	1.38	.24	.61	.26	1.39
	Owns livestock***		1.29	.74	3.04	.08	3.64	.85	15.58
Farm related Characteristics	Operational holding	Medium**	1.02	.51	4.00	.05	2.79	1.02	7.61
		Large*	1.79	.61	8.62	.00	5.96	1.81	19.66
	GCA (acres)**		-.08	.03	4.85	.03	.93	.87	.99
	CGP acreage (acres)*		.29	.10	9.14	.00	1.34	1.11	1.61
	Farm to road distance(km)		.17	.18	.96	.33	1.19	.84	1.68
	Constant		-.34	.94	.13	.72	.71		
Hosmer and Lemeshow test : 10.6 (.22)					Chi-square value: 48.1 (.00)				
-2 Log likelihood : 198.6					Total percent correct classification: 73.6%				

Note: *, **, and *** indicate variables are significant at 1, 5, and 10% respectively; N = 178, CF =89, NCF = 89

There is not much difference in the preliminary and final model as the predictive accuracy percentage and the significant variables are the same. Except that final model has lesser variables and lower standard errors. Of the 10 explanatory variables in CGP participation model (Logit), five variables viz. crop experience, livestock ownership, operational holding, GCA, and CGP acreage were found to be statistically significant. As in preliminary model, model chi-square test was found to be significant and H-L test not significant which indicates that model has adequate fit. The final CGP participation model also satisfied the assumption of linearity of continuous predictors and no multicollinearity among all predictors.

In case of onion, of the 14 explanatory variables in preliminary CGP participation model (Logit), three variables viz. farm and crop experience, and Rabi onion acreage were found to be statistically significant. Both Model chi-square and H-L test were insignificant. The overall model had a predictive accuracy of 61.5%.

Table 6.32: Preliminary onion participation model (Logit)

Variables in the Equation			B	S.E.	Wald	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Farmer Characteristics	Age (years)	41_55	.18	.41	.20	.65	1.20	.54	2.67
		>55	.51	.60	.74	.39	1.67	.52	5.37
	Schooling	secondary	.11	.38	.08	.77	1.12	.53	2.37
		higher secondary	.55	.43	1.61	.20	1.73	.74	4.03
	Crop experience (years)	9-16**	-.86	.44	3.85	.05	.42	.18	1.00
		>16***	-.82	.46	3.25	.07	.44	.18	1.07
Farm experience (years)	16-30**	.92	.47	3.83	.05	2.52	1.00	6.33	
	>30	.81	.64	1.60	.21	2.26	.64	7.97	
Household characteristics	HH Size (units)		-.06	.08	.63	.43	.94	.81	1.09
	Access to subsidiary income		.41	.33	1.51	.22	1.50	.79	2.86
	Owns livestock		-.11	.75	.02	.89	.90	.21	3.89
	Credit constraint		.20	.35	.33	.56	1.22	.62	2.43
	House type (Pucca)		-.18	.37	.23	.63	.84	.40	1.74
Farm related Characteristics	Operational holding	Medium	.32	.44	.53	.47	1.38	.58	3.29
		Large	.86	.58	2.17	.14	2.36	.75	7.40
	GCA (acres)		-.03	.02	2.57	.11	.97	.93	1.01
	Onion Rabi area (acre)***		.35	.18	3.63	.06	1.42	.99	2.03
	Farm to road distance(km)		.00	.10	.00	.97	1.00	.82	1.21

	Agricultural assets	25001 -50000	-.57	.40	2.05	.15	.56	.26	1.24
		>50000	.26	.49	.28	.60	1.29	.49	3.39
	Constant		-.88	1.12	.62	.43	.42		
Hosmer and Lemeshow test : 4.6 (.8)					Chi-square value: 25.4 (.19)				
-2 Log likelihood : 250.7					Total percent correct classification: 61.5%				

Note: *, **, and *** indicate variables are significant at 1, 5, and 10% respectively; N = 200, CF =108, NCF = 92

After initially running the preliminary onion participation model, the final model was ran with only eight predictors. The final onion participation model is presented in Table 6.33. As shown in the Table 6.32, the estimated coefficients and odd ratios of the crop experience categories (9-16 and 16> years) were similar. With the thought of parsimony, crop experience with a dichotomous covariate coded “0 for 0-8 years and 1 for more than 8 years” have been modelled in the final model. With lesser variables and lower standard errors in the final model of eight explanatory variables, six variables viz. farm and crop experience, operational holding, GCA, Rabi onion acreage, and agricultural assets were found to be statistically significant. Overall, predictive accuracy percentage had increased marginally to 63%. Model chi-square test was found to be significant and H-L test insignificant suggesting that model has adequate fit. The final onion participation model also satisfied the assumption of linearity of continuous predictors and no multi-collinearity among all predictors.

Table 6.33: Final onion participation model (Logit)

Variables in the Equation			B	S.E.	Wald	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Farmer Characteristics	Farm experience (years)	16-30**	.86	.41	4.41	.04	2.36	1.06	5.25
		>30	.49	.45	1.18	.28	1.63	.68	3.95
	Crop experience	>8 years **	-.85	.38	5.02	.03	.43	.20	.90
	Schooling	secondary	.01	.37	.00	.97	1.01	.49	2.08
		higher secondary	.45	.42	1.14	.29	1.56	.69	3.55
Household characteristics	Access to subsidiary income		.39	.33	1.46	.23	1.48	.78	2.81
Farm related Characteristics	Operational holding	Medium	.37	.43	.72	.40	1.44	.62	3.37
		Large***	.94	.56	2.78	.10	2.55	.85	7.67
	GCA (acres)***		-.04	.02	3.37	.07	.96	.93	1.00
	Onion Rabi area (acre)***		.32	.17	3.44	.06	1.38	.98	1.94
	Agricultural assets (Rs.)	25001-50000***	-.67	.38	3.11	.08	.51	.24	1.08

	>50000	.18	.48	.14	.70	1.20	.47	3.09
Constant		-.38	.53	.51	.47	.68		
Hosmer and Lemeshow test : 4.0 (.86)					Chi-square value: 23.2 (.03)			
-2 Log likelihood : 252.73					Total percent correct classification: 63%			

Note: *, **, and *** indicate variables are significant at 1, 5, and 10% respectively; N = 200, CF =108, NCF = 92

Within farmer characteristics, age and schooling did not seem to influence onion and CGP farmers' participation in the contract; however inexperienced farmers are more likely to grow crop under contract. In case of both the crops CGP and onion, the odds of contract farming participation was lower as crop experience increase. For e.g., odds of a farmer being under contract in 2012 season is with contract crop experience between 9 and 16 years and 16 years and more is 0.4 times and 0.08 times likely compared to crop experience of eight years and less (Table 6.31). Similarly, odds of a farmer being under onion contract in 2011-12 Rabi season, with contract crop experience more than eight years is 0.4 times likely compared to farmers with crop experience of eight years and less (Table 6.33). In the case of CGP, farming experience variables were insignificant, whereas in onion farmers having experience of 16-30 years were 2.3 times more likely to be under contract compared to farmers having experience with 15 years and less. Whereas variable 'farmers with more than 30 years' experience were insignificant, indicating that younger and middle-aged onion farmers were more likely to grow under contract compared to elderly. The reasoning for this would be that as more experienced growers understand the crop's technical and market dynamics and thus, they are more likely to grow the crop on its own. Also for onion, more experienced and elderly farmers were hesitant to grow new crop variety. Similar, results were observed in Deshpande (2005), Ramaswami et al. (2006), Simmons et al. (2005).

In case of household characteristics, household size, access to subsidiary source of income within the household were not found to be playing a key role in farmers' contract participation for both the crops. However, for CGP, farmers having livestock were thrice likely to participate compared to those who did not have access to contract farming. Although, this variable was significant at 10% level of significance.

For farm related characteristics, operational holding and contract crop acreage were found as positive determinants for contract farming participation in both the crops. In case of CGP, odds of a farmer being under contract for medium and large category farmers were is 2.8 times and six times more likely compared to the small category.

Similarly, large onion farmers were more than twice likely to be under contract compared to small farmers, however, this variable was significant at 10% level of significance, while medium category variable was insignificant indicating that small and marginal onion farmers were equally likely to participate in contract farming. Also, with a one-acre increase in contract crop acreage for the reference season, the probability of contract farming participation increases by 30% for both CGP and onion farmers. In contrast, with a one-acre increase in GCA, the probability of CF participation decreases by 8% and 4% for CGP and onion farmers respectively.

Agricultural assets variable was insignificant in case of CGP, but for onion, as farmers asset increased, its odds of contract farming participation decreased. As farmers within the category of agricultural assets less than Rs. 25,000 were twice more likely to be under contract than farmers within the category of agricultural assets of Rs. 25,001-50,000. Thus onion farmers with lower agriculture assets were more likely to be under contract. This again reflects that contract farming helps less endowed farmers to cultivate cash crop.

6.4 Concluding remarks

Based on descriptive results of section 6.1, it was found there was no significant difference between the social group and occupational profile of CF and NCF categories for both the crops. Overall, except for agricultural assets, there were no significant differences in socio-economic and demographic indicators between CF and NCF. Thus, asset wise CF and ACF were better endowed compared to NNCF. One of the reason, for better endowment of agricultural assets among CF and ACF, is that after they had started contract cultivation, they had also started investing in assets such as MIS and sprayers.

For both the crops, descriptive statistics show that operational holding is higher in the case of CF compared to NCF. Overall for both the crops, NNCF have lower holdings within NCF compared to ACF. The distribution pattern of operational holding is similar within CF and ACF categories in both the crops. For both crops, average GIA, GCA, and NSA was highest in the case of ACF, followed by CF and then NNCF. Thus, ACF follow more intensive cultivation, compared to CF and NNCF.

CGP acreage is higher for CF and ACF, while it is very low for NNCF. Thus, those farmers who have larger acreage under CGP are either CF or ACF. Larger CGP acreage means larger investment and risks. Thus these farmers grow CGP under contract

to address the production and market risks. While the intensity of adoption of onion is highest among CF, followed by CF and NNCF.

CGP ACF has higher farming and crop experience compared to CF and NNCF. In the case of onion, it is NNCF which had higher farming and crop experience. Overall from the both crops survey, it seems less experienced farmers are more likely to be associated with the contract.

NCF comprises of ACF and NNCF. While ACF is endowed better with agricultural assets and operational holdings. Thus, it seems as these farmers adopt the new crop and technologies, then later they no longer felt the need to be in the contract. The financial position of CF and ACF is better compared to NNCF as they have lower agricultural assets.

The Logit results confirmed that large category farmers and those having high contract crop acreage, and those with less crop experience have preference for contracts. One of the reasons for this is it that large CGP farmer considered contracting as a hedging mechanism, whereby they would have a guaranteed buyer, as in case price goes down large CGP growers can sell their produce to Pepsico. In the case of onion, farmers with lower agriculture assets were more likely to be under contract. Thus, contract farming seems to facilitate cash crop adoption and crop diversification even among small and farmer with lesser resource base. Results also suggest that contracting is a strategy of the farmers to reduce the risks.

The farmers' experience under contract and reasons for their participation, ACF disadoption from contracting, and why NNCF never participated in contract would be discussed in the next chapter.