Task- and Risk-Mapping Study of Hybrid Vegetable Seed Production in India

Data Collected by Dr. Davuluri Venkateswarlu

Edited by Sarah Labowitz, Fair Labor Association

June 2007

Summary

The FLA commissioned the study to better understand the tasks and labor compliance risks in the production of Syngenta Seeds' vegetable seeds in India. The study provides an overview of the various production processes for vegetable seeds, describes the actors involved in the vegetable seed production chain and defines workforce and employment relationships in the sector. Crop calendars are provided for seven crops. The study makes recommendations for monitoring of high-risk tasks, as well as for training and capacity-building needs to improve labor compliance on seed production farms.

Contents

Tables, Charts and Illustrations

Background

In the summer of 2003, reports of child labor on cottonseed farms producing for multi-national agribusiness companies in the Indian state of Andhra Pradesh made headlines in European newspapers. As a result of the reports of child labor in its supply chain, Syngenta Seeds, Inc., one of the companies supplied by the farms in Andhra Pradesh, initiated consultations with other agribusiness companies, the Indian government and local and international NGOs to develop an industry-wide action plan to eliminate child labor on the cottonseed farms.

In addition to the effort to eliminate child labor in Andhra Pradesh, Syngenta joined the Fair Labor Association (FLA) in 2004 as the first agribusiness member of the association. Historically, the FLA's monitoring methodology for labor compliance has been applied to apparel and footwear companies supplied by factories across the globe. The FLA's code of conduct is based on labor standards set by the International Labor Organization.

Syngenta's admission into the FLA was designed as a pilot project to test the applicability of FLA methods used in apparel and footwear factories to the agricultural context. The FLA developed a monitoring plan with Syngenta focusing initially on cottonseed, and later expanding to include the company's other kinds of seed production. The plan included development of an internal monitoring system for agricultural production processes and independent verification.

In 2005, Syngenta sold its global cottonseed business to Delta and Pineland, a U.S-based seed company. Following the sale, the FLA and Syngenta determined that the company's monitoring efforts would shift to hybrid vegetable seed production in India, which represented the next highest area of labor compliance risk after cottonseed. Following the adoption of a monitoring system for vegetable seeds, the plan dictates the extension of the system to all field-based crops.

Objectives

Unlike cottonseed production, little information is available regarding the production processes and associated risks of vegetable seed crops. This study represents the first step in mapping the production processes and risks associated with vegetable seed production in India. The study focuses on three areas:

1. Task- and risk-mapping for production processes of vegetable seed crops.
2. Identification of tasks and timelines for monitoring of the production processes.
3. Identification of training and capacity-building needs for Syngenta field staff, seed organizers[1] and farmers in implementing the FLA labor compliance methodology.

[1] The term "seed organizers" refers to third party agents who function as go-betweens between Syngenta and the seed farmers. See page 5 for definitions of the various actors in the production chain.

Methodology

Data was collected from field visits and interviews conducted from April 26 to May 16, 2006 at three production sites in three states in India. Data was collected primarily through interviews with Syngenta field staff, seed organizers, farmers and workers. Further studies are required to observe seed production processes and associated risks during the growing season and to verify data collected through interviews. Only watermelon seeds were observed in production at the time of the interviews.

The three production sites are located in Ranibennur in Karnataka, Deulgaon Raja in Maharashtra, and Idar in Gujarat state.

Task- and risk-mapping were conducted for the production cycles of seven seeds:

- Okra
- Hot pepper
- Sweet pepper
- Eggplant
- Tomato
- Bean
- Watermelon

Syngenta organized the field trips to the production sites. Mr. Kulkarni, the Syngenta staff person in charge of monitoring activities and the liaison between Syngenta and the FLA in India, participated in the field visits and was present at all interviews.

Overview of Syngenta's Vegetable Seed Business

The market for hybrid vegetable seeds is rapidly growing in India and both national and multi-national companies are active in the market. Hybrid vegetable seed production in India is largely concentrated in three states: Karnataka in the south and Maharashtra and Gujarat in the central-west region.

Tomato seed production using greenhouse technology.

Syngenta, a Swiss multinational, is among the top five vegetable seed producers in India, accounting for 20 to 25% of the Indian market. Vegetable seed production accounts for 40% of Syngenta's total seed business in India; the remaining 60% is split between sunflower seeds (50%) and other field crops (10%).

Syngenta's vegetable seed production is concentrated in three sites located in the Ranibennur area of Karnataka, the district of Deulgaon Raja in Maharashtra and the Idar district in Gujarat.

In 2005-06, approximately 4,000 farmers operating 4,800 small plots produced Syngenta's vegetable seeds in India. Total acreage for vegetable seed production was 2,641 acres, which was split between small seed production[2] (234 acres) and large seed production[3] (2,410 acres). Table 1 presents the distribution of production area among the three regions.

Table 1: Regional Distribution of Production Area for Large and Small Vegetable Seeds (2005-06)

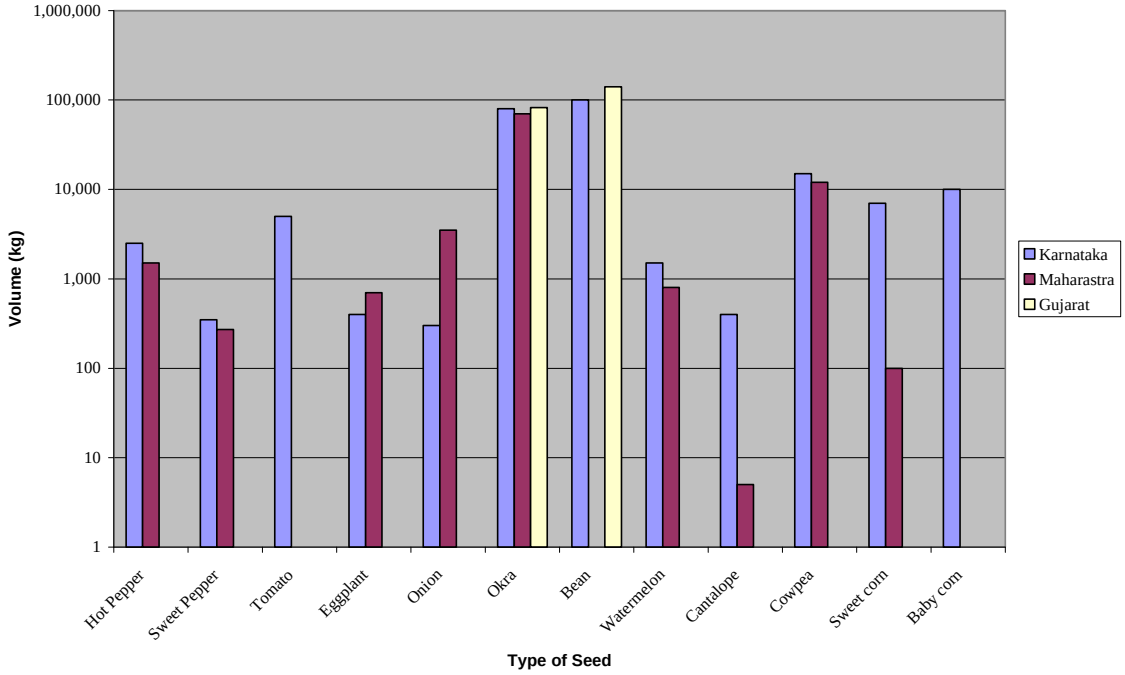
	Total Production Area		**Small Seed Production**		**Large Seed Production**	
	%	Acres	%	Acres	%	Acres
Karnataka	50	1,082	75.6	177	37.6	905
Maharashtra	40	659	24.4	57	25.0	602
Gujarat	10	900	-	-	37.4	900
Total		**2,641**		**234**		**2,407**

The average size of the vegetable seed production farm is very small. For small seed crops such as tomato, sweet pepper and hot pepper, the average farm size is ¼ acre in Maharashtra and ½ acre in Karnataka. In the case of large seed crops such as okra,[4] the average farm size is one acre in Karnataka and ¼ acre in Maharashtra and Gujarat. See *Appendix 1, Vegetable Seed Production Area and Quantity by Region (2005-06)* for detailed information on each type of vegetable seed. Chart 1 illustrates the volume distribution for each crop.

In recent years Syngenta has encouraged seed farmers to use greenhouse technology (in which seeds are housed under a net) for small seed crops. It was reported that during 2005-06 most of the farmers growing hot and sweet peppers and tomato crops used greenhouse technology for production of these crops.

[2] Small seeds vegetable crops include tomato, sweet and hot peppers, eggplant and onion.
[3] Large seed vegetable crops include okra, bean, watermelon, cowpea, and sweet and baby corn.
[4] Okra alone accounted for 44% of large seed production (1,070 acres).

Chart 1: Volume of Vegetable Seed Production by Region (2005-06)



Production Chain

Syngenta depends on local seed farmers for the production of hybrid vegetable seeds in India. While seed production is conducted by farmers in their own fields, Syngenta does not make direct agreements with the farmers. Rather, the company makes production agreements with third party seed organizers. The production agreement is a buy-back arrangement, whereby the company sets the price for the foundation seed supplied to the organizer, as well as the procurement price the company will pay for the seed product at the end of the season. The agreement specifies the type and quantity of seed to be produced, quality of seed expected and service charges or commissions to be paid to the seed organizer.

It is the responsibility of the seed organizer to identify farmers to produce the seed according to the targets set in the production agreement. Organizers determine the production area and number of farmers based on targets set by the company. Individual agreements are made between the organizer and each farmer that replicate the terms and conditions set by the company in the production agreement with organizers. Syngenta advances production capital to the seed organizers.

Although the company is not directly involved in making agreements with seed farmers, Syngenta exerts substantial control over farmers and their production processes through the supply of foundation seed, fixing of procurement prices and quality supervision. Syngenta fixes the prices paid to farmers and sets the quality standards to be followed by farmers for cultivation of seeds in the field. Company field supervisors make frequent


Syngenta field staff and women workers in an okra field in Karnataka.

visits to the fields to check that company standards are being followed in seed production.

In Maharashtra the entire company's vegetable seed production agreement is given to one third party organizer, Godavary Krishi Vikas Kendra (GKVK). Similarly, in Karnataka Syngenta organizes its entire production through a single third party. These third party organizers act as intermediaries between the company and seed farmers. In contrast to Karnataka and Maharashtra, Syngenta in Gujarat has several seed organizers working for it.

Major Tasks and Associated Risks

Task-mapping was conducted for six vegetable hybrid seed crops: okra, hot pepper, sweet pepper, eggplant, tomato, bean and watermelon. Eight tasks are common to the production of these seed production crops:

- Sowing/transplanting
- Weeding
- Fertilizer application
- Pesticide application
- Staking and pruning
- Hybridization
- Harvesting
- Seed extraction, cleaning, drying and acid treatment

Sowing/transplanting: For all crops except okra and beans, which are sown directly in the field, seeds are transplanted as seedlings from a nursery. Syngenta contracts directly with centralized third party nurseries that supply farmers with seedlings. Sowing and transplanting is skilled work.

Risk: No major risk involved.

Fertilizer Application: Fertilizers—both bio and chemical—are applied to plants either through direct application at the base of the plant or through mixing with irrigation water that is supplied to the plants through drip pipes.

Risk: No major risk involved.

Pesticide Application: Tomato, hot and sweet peppers and eggplant are highly disease-prone crops; large quantities of toxic pesticides are used to reduce the incidence of disease. During the peak season, pesticides are applied twice per week. Pesticide

application is done manually by spraying through a hand pump. Workers spraying pesticides should wear personal protective equipment (PPE), including gloves and face masks. (Because the interviews were conducted out of season, further observation is necessary to determine if PPE is actually worn during pesticide application.)

Risk: The pesticides used are highly toxic and are harmful to humans. Unless all proper precaution is taken in storing, mixing and spraying, the chemicals can cause health problems for the workers applying the pesticides, as well as other workers in the field. Risk is particularly high during the hybridization period, when pollination is done on the same day that pesticides are applied. Interviews with farmers and Syngenta field staff indicate that some precautions are taken during pesticide application, but ongoing monitoring is necessary to determine best practices.


Chemical storage on a farm in Karnataka.

Weeding: Weeding is done manually.

Risk: No major risk involved.

Staking and Pruning: Staking facilitates the handling of plants during emasculation and pollination. Staking also keeps the ripening fruits above ground and prevents rotting. The female parent is staked. Inferior or virus-infected plants are pruned before hybridization.

Risk: No major risk involved.

Hybridization (Emasculation and Pollination): Hybridization involves two separate tasks: emasculation and pollination, both of which are done manually. In hybrid seed production, self-pollination is not allowed.

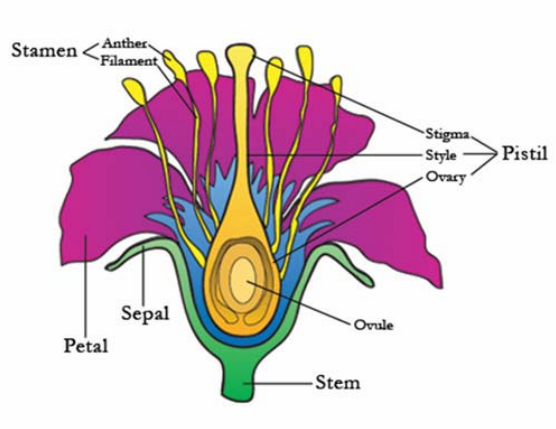
Emasculation involves removal of the stamen from the flower bud of the female line before the flower sheds its pollen. Emasculation must occur without damaging the stigma, style or ovary. For tomato and pepper crops, sharp-pointed forceps are used to force open the selected buds and remove the anther cone from the bud, leaving the calyx, corolla and pistil. For okra crops, removal of the stamen from the flower bud is done using the thumbnail. Emasculation is carried out in the late afternoon and evening, from the hours of 3 to 6 pm. Emasculated flowers are tagged for identification.

Pollination is achieved by exposing the stigma and dipping it into a pool of pollen that has been collected in a container from male parent flowers. Pollination is done in the morning between 5 and 9 am.

For small-seed crops such as tomato and peppers, collection of pollen is achieved by collected male parent flowers and removing their anther cones. The anther cones are dried under a drying lamp, then transferred to a glass or cup covered with a fine mesh screen. The cup is sealed with a lid and shaken so that pollen is collected in the lid. The pollen is transferred to an easy-to-handle container for use in pollination.

Risk: Emasculation and pollination are labor-intensive activities that require a large workforce to complete. As such, these activities come at considerable expense to farmers. Farmers secure a stable workforce by advancing payment or making loans to workers before the season begins. Because of the size and expense of the workforce required, the risk of child labor (both family and hired) is high, as well as the risks of forced or bonded labor and forced overtime. The late afternoon/evening and early morning hours involved in emasculation and pollination exacerbate the risk of forced overtime. Furthermore, these activities require fast and repetitive movements which are very tiring because of the lack of recovery time between movements. Removal of the sticky stamen with the thumbnail as required in okra emasculation presents a risk of injury to fingers.

Illustration 2: Anatomy of a Flower



Harvesting: Collection of fruits from plants.

Risk: Like emasculation and pollination, harvesting is a labor-intensive activity. Tomato and pepper crops in particular require a large workforce for harvesting. Again, there is a risk of child or forced labor to minimize costs and increase the size of the workforce. Excessive hours of work and forced overtime are also risks.

Seed Extraction, Cleaning and Acid Treatment: Seed extraction, cleaning and acid treatment are done manually. In the case of tomato crops, the fruit is crushed by trampling with feet; crushed fruits are transferred to large plastic containers and are fermented to separate the gel mass encasing the seeds. After fermentation, seeds are transferred to other plastic containers filled with water. Seeds are agitated to separate the seeds from any flesh or skin, which float to the top. Seeds are then dried and treated with acid.

Risk: The acids used for cleaning seeds are highly toxic. Interviewees reported that acid treatment is done in the presence of Syngenta field staff and that field staff provide safety equipment to farmers during this process. Further observation is required.

Workforce and Employment

Labor Intensity

Hybrid vegetable seed production is a highly labor- and capital-intensive activity. Hybridization in particular is the most labor- and capital- intensive task in the production cycle because of the manual labor required to emasculate and pollinate the vegetable plant flowers. Table 3 presents the labor intensity of the different production cycle tasks. Out of a total 258 labor days to produce tomato seed, 160 days are spent on hybridization alone (62%). For hot pepper seed production (the most labor-intense of the vegetable crops), 500 of 750 total labor days are spent on hybridization (66%). After hybridization, harvesting is the next most labor-intensive activity.

Gender Division of Labor

Study of the gender division of labor indicates that women play a prominent role vegetable seed production. Women carry out the hybridization, weeding and harvesting activities that represent 70 – 75% of the total labor days for the different crops. Men are mostly involved in pesticide and fertilizer application. Table 2 presents the gender division of the various production tasks.

Table 2: Gender Division of Production Processes for all Crops

	Gender Division
Sowing/transplanting	Female
Fertilizer application	Male
Pesticide application	Male
Weeding	Female
Hybridization	Female
Harvesting	Female
Seed extraction & cleaning	Female

Child Labor

In all the three production locations there is a general practice of using children (both hired and family children) in seed production activities. While most farmers interviewed acknowledged the use of child labor in general, they denied the existence of child labor on their own farms, saying that they had recently given up the practice under pressure from Syngenta field staff. It should be noted that these interviews were conducted in the presence of Syngenta field staff. Most farmers are aware that the use of child labor is illegal under Indian law and prohibited under the agreements to produce for Syngenta. It was not expected that farmers would be honest about their own use of child labor, and further investigation is required.

Terms and Conditions of Employment

Hybrid vegetable seed production requires a long-term, stable workforce to carry out the specialized production activities. In Karnataka and Maharashtra, farmers make long-term

arrangements with workers by making pre-season payment advances and loans to them. In Karnataka, farmers pay each worker INR 3,000 – 4,000 (USD $69 – 92) at the beginning of the season to bind workers to the farm throughout the entire season. A similar pattern is observed in Maharashtra.

Daily wage rates for female workers vary from INR 25 – 40 (USD $0.57 – 0.92) in Karnataka and INR 30 – 45 (USD $0.69 – 1.04) in Maharashtra. Daily wage rates for male workers involved in fertilizer and pesticide application vary from INR 50 – 60 (USD $1.15 – 1.38). The workday varies from nine to 12 hours per day depending on the task. During cross pollination, working hours are extended to accommodate pollination activities conducted in the early morning hours and emasculation activities, which occur in the late afternoon and evening. During this time, workers arrive in the field at 6 am and work until 6 pm with a two-hour break.

Table 3: Labor Intensity of Production Processes
(Number of labor days per ½ acre farm)

	Okra	Hot Pepper	Sweet Pepper	Eggplant	Tomato	Bean	Water-melon
Sowing/transplanting	8	8	8	6	4	5	4
Fertilizer application*	2	3	3	2	2	2	2
Pesticide application**	6	18	18	12	12	5	4
Weeding	64	64	40	24	16	15	12
Hybridization	200	500	180	200	160	Open pollination	48
# of days / # of ppl†	25 / 8	20 / 25	15 / 12	20 / 8	20 / 8		8 / 6
Harvesting	48	64	30	20	24	5	4
Seed extraction & cleaning	28	100	90	40	40	-	15
Total labor days	**356**	**757**	**369**	**304**	**258**	**32**	**89**

* Fertilizer application requires half day's work by one person.
** Each pesticide application requires half a day's work by two people—one person to spray and the other to assist in mixing chemicals and carrying water.
† Number of people required to complete the activity.

Crop Calendars

Crop Duration

Crop duration and timeline for production processes vary from crop to crop, from 100 to 220 days. Okra, eggplant, tomato, bean and watermelon have crop durations of 100 to 150 days; sweet and hot peppers have durations of 200 to 220 days.

Sowing and Transplanting

For most crops, sowing and transplanting activities take place in the months of July, August and September.

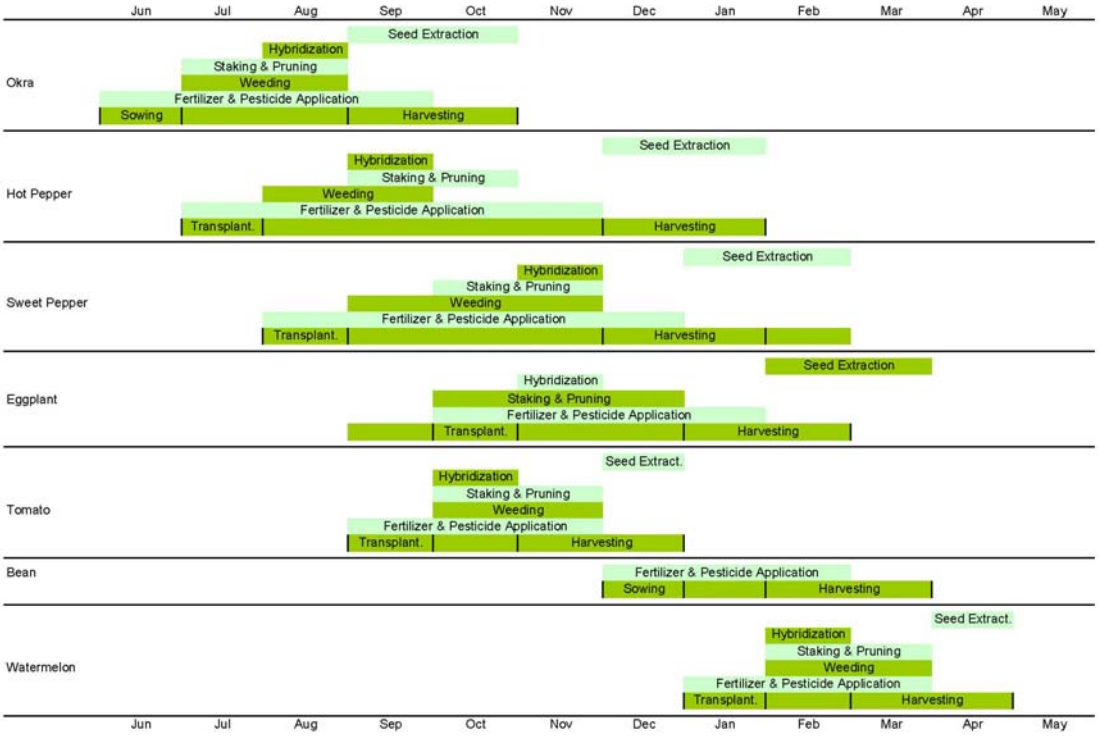
Hybridization

Hybridization (emasculation and pollination) for most crops occurs from September to November. Historically, the preferred period for growing okra, sweet and hot peppers

and tomato is during the *Kharif* season from, June to December; for bean and watermelon, the preferred growing period is during the *Rabi* season, from January to June. In recent years, the introduction of greenhouse technologies for growing small seed crops has enabled farmers to produce these seeds year-round, depending on market demands.

Fertilization
For most crops, fertilizer application (direct or through drip irrigation) is done four times: basal dose, vegetative stage, before pollination and after pollination.

Chart 2: Crop Calendar for Vegetable Seed Crops



Monitoring Recommendations

Task- and risk-mapping viewed together with the crop calendars reveal key periods for monitoring in the vegetable seed production sector. Major tasks and associated risks are listed below and recommendations for monitoring are made.

Hybridization and Harvesting
The labor-intensity of the hybridization and harvesting tasks presents workforce challenges to farmers. To keep worker turnover and costs to a minimum, farmers engage workers through pre-season agreements featuring advance payments and loans that bind the workers to the farm for the entire season. *Possible labor compliance risks exist for child labor, forced or bonded labor, forced overtime and wage violations*.

Pesticide Application
Large quantities of highly toxic pesticides are used particularly in hot pepper, sweet pepper and tomato production. Both the workers who mix and spray the pesticides and the workers in the field carrying out other operations must take precautionary measures to prevent injury from exposure to pesticide chemicals.

Health and safety risks exist related to the non-use of personal protective equipment when risk of exposure to pesticides is high, particularly during hybridization activity. During the hybridization period, pesticide application occurs on the same day that workers in the field conduct emasculation and pollination tasks.

Seed Extraction and Acid Treatment
Chemicals used in seed treatment are toxic. Syngenta field staff report that farmers conduct seed treatment in the presence of field staff and that safety equipment is provided to the farmers. Further observation is required, but *the health and safety risk of exposure to dangerous chemicals is high during seed extraction and acid treatment*.

Monitoring Recommendation
The period from September to December is the critical period for monitoring in the vegetable seed production sector. During this period, the highest-risk activities of hybridization and harvesting, pesticide application and seed extraction and acid treatment occur for most crops.

Regional and Crop-Specific Risks

Of the three regions where production of vegetable seed takes place, Karnataka presents the highest risk as compared to Gujarat and Maharashtra. Particularly in the Gadag and Koppal districts of Karnataka, the practice of using child labor in seed production activities is quite common due to large areas of small seed production requiring a large labor force.

Compared to large seed and other small seed crops, tomato represents the highest risk among the crops studied. In general, small seed crops represent higher risk than large seed crops because of the high degree of labor and capital intensity. The large size of the workforce required presents higher risks for child labor, forced overtime and wage violations in the production of these crops. Syngenta field staff report that the company gives production contracts only to a select group of reliable farmers who have long-term relationships with the company.

Training and Capacity-Building Needs

Discussions with Syngenta field staff, seed organizers and farmers clearly indicate that the actors in the production chain have limited understanding or awareness of the company's policy on human rights, health and safety issues and Syngenta's project with the FLA. There is some general awareness among field staff, organizers and farmers

regarding the issue of child labor. However, this understanding is not consistent among all the actors.

The contract used by Syngenta for agreements with seed organizers and farmers has a provision which bans the use of child labor, but there is no definition given for “child labor” or the age of young workers in the contract. Age definition of young workers varied among interviewees between 14 and 15 years old.


Syngenta field staff recording data in the field.

There is little awareness of the FLA Code of Conduct among field staff, organizers and farmers. Syngenta must clearly communicate the code to the actors in the production chain. Ongoing trainings are necessary to keep field staff, organizers and farmers informed.

Appendix 1: Vegetable Seed Production Area and Quantity by Region (2005-06)

	Karnataka			Maharashtra			Gujarat		
	# of plots	Area (acres)	Volume (kg)	# of plots	Area (acres)	Volume (kg)	# of plots	Area (acres)	Volume (kg)
Small Seed									
Hot Pepper	180	45	2,500	80	20	1,506	-	-	-
Sweet Pepper	60	15	350	50	12	271	-	-	-
Tomato	220	110	5,000	-	-	-	-	-	-
Eggplant	10	5	400	65	No data	700			
Onion	2	2	300	25	25	3,500	-	-	-
Large Seed									
Okra	450	450	80,000	880	220	70,000	1,600	400	82,000
Bean	250	250	100,000	-	-	-	250	5600	140,000
Watermelon	55	55	1,500	60	15	800	-	-	-
Cantalope	30	30	400	1	.25	5	-	-	-
Cowpea	80	80	15,000	180	180	12,000	-	-	-
Sweet corn	25	25	7,000	5	2	100	-	-	-
Baby corn	15	15	10,000	-	-	-	-	-	-

Appendix 2: Detailed Crop Calendar for Different Vegetable Seed Crops

	Okra	Hot Pepper	Sweet Pepper	Eggplant	Tomato	Bean	Watermelon
Duration	Jun - Oct 100 - 120 d.	Jul - Jan 200 - 220 d.	Aug - Feb 200 - 220 d.	Sep - Feb 120 d.	Sep - Dec 120 d.	Dec - Mar 100 - 120 d.	Jan - Apr 100 d.
Sow/transplant	June	Jul - Jan	Aug	Oct	Sep	Dec	Jan
Fertilizer app.	Jun - Sep 4 times	Jul - Nov 6 times	Aug - Dec 6 times	Oct - Jan 4 times	Sep - Nov 4 times	Dec - Feb 3 times	Jan - Mar 4 times
Pesticide app.	Aug & Sep 6 times	Aug - Nov 15 - 20 sp.	Oct - Dec 18 - 20 sp.	Nov & Dec 12 - 15 sp.	Oct & Nov 10 - 12 sp.	Jan & Feb 5 times	Feb & Mar 3 - 4 times
Weeding	Jul & Aug	Aug & Sep 6 - 8 times	Sep - Nov 6 - 8 times	-	Oct & Nov	2 - 3 times	Feb & Mar 3 times
Staking & pruning	Jul & Aug	Sep & Oct	Oct - Nov	Oct - Dec	Oct & Nov	-	Feb & Mar
Hybridization	Aug 21 - 30 d.	Sep 18 -30 d.	Nov 15 d.	Nov 20 d.	Oct 20 d.	Open pollination	Feb 6 - 8 d.
Harvesting	Sep & Oct 4 pickings	Dec & Jan 4 pickings	Dec & Jan 4 pickings	Jan & Feb 4 pickings	Nov & Dec 4 pickings	Feb & Mar	Mar & Apr
Seed extraction & cleaning	Sep & Oct	Dec & Jan	Jan & Feb	Feb & Mar	Dec	-	Apr

d. = days
sp. = sprays