



Weather Indexed Insurance for Rain on Tomato Crop in California

It's been observed that the heavy rain during the harvesting season in California has the negative impact on the yield of processing tomato. The following example illustrates the development of an insurance product for Rain on Tomato in Fresno County of California.

Introduction

California is the largest processing tomato producer in United States with about 95% of the total nationwide production. The major producing counties are Fresno, Yolo, San Joaquin and Kings. Fresno alone produces 45% of total state production.

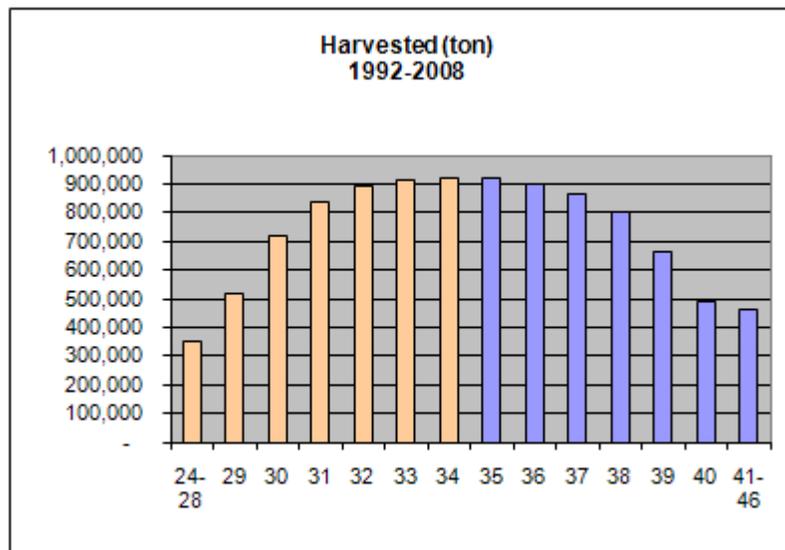


The table below shows a quick comparison of the critical planting and harvesting dates in California and other States. The plating date is a lot earlier in California normally after the New Year.

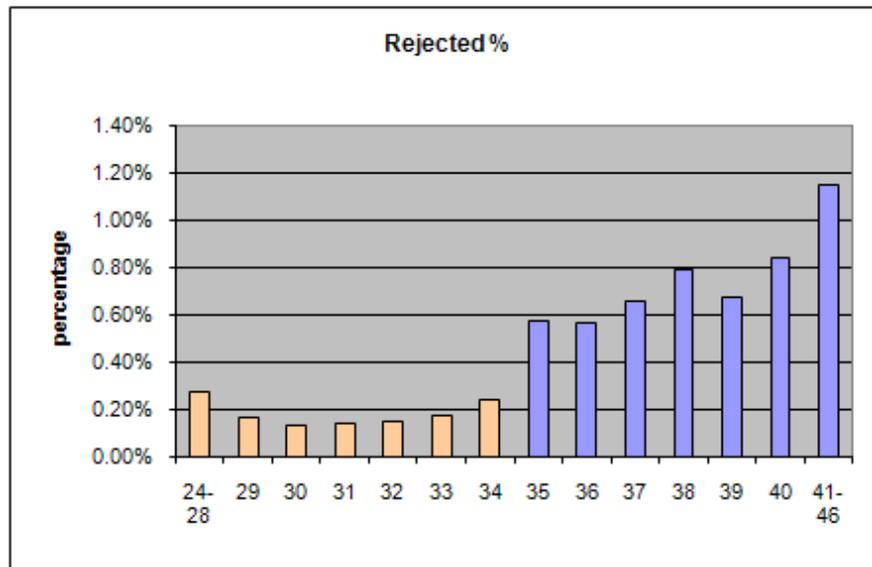
Processing Tomato						
State	Average Production (Ton) 2004-2006	Planting Dates MM/DD		Harvesting Dates MM/DD		
		Begin	End	Begin	Most Active	End
CA	10,458,667	1/1	5/31	6/1	6/25 -10/5	10/31
IN	255,593	4/20	6/18	6/27	8/5 - 9/30	10/12
MI	112,000	5/1	6/15	7/20	8/1 - 9/30	10/31
OH	173,140	4/25	6/15	7/1	7/1 - 9/30	10/15

Weather Effects

According to California processing tomato historical harvesting data, the harvest season starts in June or roughly in the week of 24-28th of the year. The chart below shows the average harvest tonnage by the week. The harvest peaks at late August (week 34-35) and ends at end of November. During this period, the incidence of rainfall increases in the central valley. The excessive moisture on the ripe tomato often result in rotten and/or molded produce thereby sub-standard tomatoes for industry use.



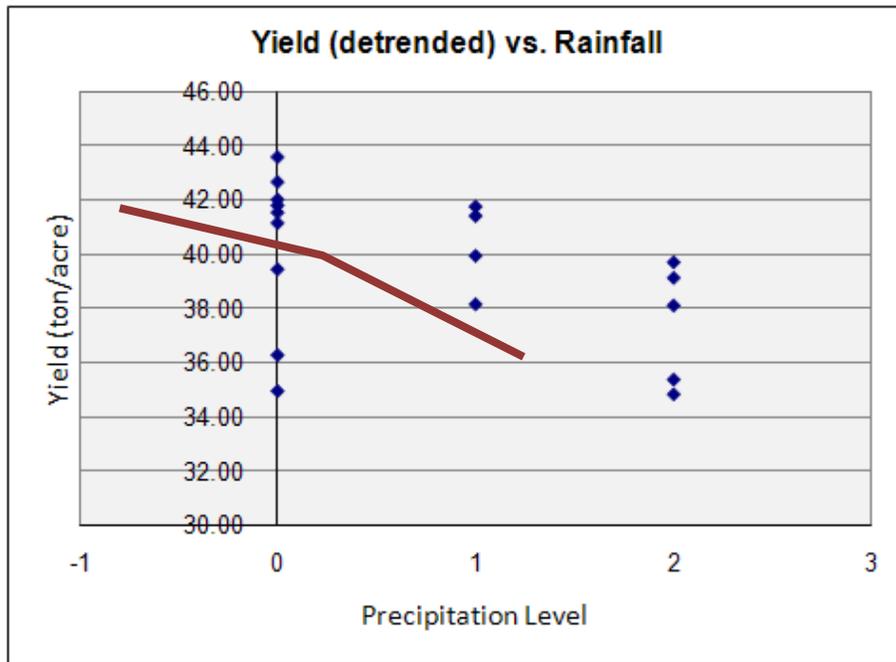
The historical rejection rate due to low quality shows that in the second half of the harvest season (between 35th week and 46th week of the year), the rate is significantly higher than that of the first half of the season (see the chart below). This is a direct indication of production loss from excessive rain as farmers sometime give up the fields by not harvesting at all.



Rain Index on Tomato

Using the long term historical daily rainfall data and yield information, it is discovered that

- When the daily precipitation between August 1st and October 30th is less than 0.05 inch, the average yield is about 42 tonnages per acre which is about the normal yield level. As such, the level of rainfall is not excessive and has no effect on yield.
- When the precipitation is in-between 0.05 inch and 0.2 inch, the aggregated average county yield is about 40 tonnages per acre or drop about 5%.
- When the precipitation is greater than 0.2 inch, the aggregated average county yield falls around 36 tonnages per acre or drop about 15%.



Based on the above correlations study and average value per ton for tomato, a rain index insurance coverage is shown in the table below with four proposed triggers and associated payouts per acre. The maximum daily precipitation value during risk period is used to assess the triggering events.

	Phase	Phase - I	Phase - II	Phase - III
	Period	Aug 1st - 31st	Sept 1st - 30th	Oct 1st - 31st
	Maximum Daily Rainfall (inch) Trigger (≥)	0.1	0.2	0.2
	Payout (\$ per 0.05 inch)	\$20	\$15	\$15
	Exit (inch)	1.0	1.5	1.5
	Maximum payout	\$360	\$390	\$390
Excess Rainfall	Total Sum of Insured	\$1,140		
	Premium	\$25		
	Rate	2%		

As-If Analysis

For example, Farmer Joe grows 3 acres of tomato that are targeted for harvesting one acre each in the above three periods respectively. For this product, Joe will pay \$75. Using past twenty years daily precipitation data as published by California Irrigation Management Information System (CIMIS), the following table shows as-if payout for Joe.

Year	Maximum Daily Precipitation (inch)			Payout (\$/acre)		
	Aug.	Sept.	Oct.	Aug.	Sept.	Oct.
1988	0.08	0	0.08	0	0	0
1989	0.04	1.03	0.2	0	240	0
1990	0	0.2	0	0	0	0
1991	0.04	0	0.04	0	0	0
1992	0.04	0	0.67	0	0	135
1993	0.28	0.04	0.08	60	0	0
1994	0.12	0.59	1.26	0	105	315
1995	0.08	0	0	0	0	0
1996	0	0	0	0	0	0
1997	0	0.2	0.08	0	0	0
1998	0	0.35	0.43	0	45	60
1999	0	0	0	0	0	0
2000	0.04	0	0	0	0	0
2001	0	0.01	0.01	0	0	0
2002	0	0	0	0	0	0
2003	0	0	0	0	0	0
2004	0	0	0.98	0	0	225
2005	0.01	0.18	0	0	0	0
2006	0	0	0.39	0	0	45
2007	0	0	1.39	0	0	345
2008	0	0	0.02	0	0	0