USE OF SOLAR ENERGY TO DRY CONES AT THE ALBUQUERQUE TREE NURSERY

Atha Boyd Elliott 1

The construction and utilization of a solar energy seed extractory proved to be very efficient for drying cones in an expeditious manner with thermostatically controlled heat, plus gave us new and useful data for drying cones in the future.

Construction of the Albuquerque Tree Nursery seed extractory was completed for processing cones in the fall of 1979. The cones were processed from October 1979 to December 1979.

The extractory is 103.5 feet long running from east to west and 60 feet wide. The fiber glass cover over the roof holds the heat so it can be pulled down into the heating unit by fans on the north end of the building. There is no heat storage capacity. The north end of the extractory is equipped with thermostatically controlled dampers that will mix in outside air to maintain a maximum of 110°F. Inside the extractory there are 5 main heat units; each unit breaks into three hookups for cone drying trays. Early in the seed year temperatures in excess of 130°F were reached if only one heat unit was running. The 110 F desired temperatures could only be maintained if other fan units were running. However, this was not the case later in the seed year.

The base tray hookups, base trays and drying trays were purchased from International Forest Seed Company in Birmingham, Alabama. Each 4' X 8' drying tray was designed to hold 6 bushels of green cones.

The trays with green cones are stacked 6 high when drying. In October, cones were ready to process in 5 days; later in the year the drying time increased to 7 or 8 days. If the extractory roof had a sharper peak for more solar contact later in the season, the drying time would probably decrease. Late in the season, the dampers never opened--even with only one unit running, and with heat being directed through one hookup.

It was necessary to store some cones in the sun while waiting for space to become available in the extractory. The parking lot to the west of the extractory is black top. When drying: trays were placed on pallets, cones would be fully opened only 2-3

1/ Atha Boyd Elliott, Nursery Superintendent, Albuquerque Tree Nursery

days later than in the drying system. This was only in the early part of the seed year. The lower angle of the sun later in the year caused uneven drying of the cones due to shading of the cones by the south side of the drying tray. Physically moving cones caused damage to the drying trays. The problem was alleviated by placing outside sun-dried cones in the system a couple of days.

The Nursery extractory has exhaust fans directly above the drying units that come on when the heating unit is turned on. The fans are designed to prevent the incoming pressure from destroying the walls. This is not a practical problem as the overhead door is always open when the cones are being processed to move trays in and out. The high fans remove most of the heat making it uncomfortably cold to work at times. If the fans are installed, there are at least 2 acceptable alternatives to the Albuquerque design: Switches, so the fans could be turned on independently of the heating unit if the overhead door was closed, or place the fans on the opposite wall so the heat would circulate through the building before being drawn out.

Table 1 is a summary of temperature readings taken periodically throughout the seed year. Next year a greater effort will be made to obtain more data. The benefit of the solar drying system is obvious. Even on cloudy days, there was a substantial temperature increase in the drying trays over the ambient air temperature. The first 4 temperature readings are from probe thermometers, the last is an unsheltered hygrothermograph.

The Nursery will purchase 100 additional drying trays to dry cones on the black top at the west end of the extractory. This will make double shifting possible in the event of a big seed year.

TABLE 1

TEMPERATURE READINGS OF SEED EXTRACTORY HEATING SYSTEM

			PROBE THERMOMETER				
DATE	TIME	WEATHER	MAIN CHUTE	BASE TRAY	#4 FROM BOTTOM	ROOF	HYGRO-THERMO-GRAPH OUTSIDE
11/5/79	1400	Clear	84	79	78	58	68
11/6/79	0840	Thin clouds	58	58	56	47	40
	1225	Overcast	75	72	75	56	56
	1535	Thick clouds	60	60	60	57	57
11/7/79	0850	Thin clouds, no direct sun. Rain in a.m.	53	53	52	46	43
11/14/79	1000	Clear	65	62	58	44	47
	1200	Clear	78	75	71	50	44
	1400	Clear	72	72	72	56	64
	1600	Clear	58	57	60	58	60
11/15/79	0830	Clear	44	44	46	42	30
	1010	Clear	46	68	66	64	48
	1200	Clear	81	78	77	54	46
	1400	Clear	77	76	78	60	63
	1600	Clear	58	60	62	60	63
11/16/79	0830	Clear	44	44	46	42	30
	1230	Clear	82	80	80	60	50
	1400	Clear	78	78	78	60	74
	1600	Clear	64	67	64	64	63
12/5/79	0830	Few high clouds	46	44	No reading	38	No reading
	1000	Clear	85	79		51	
	1230	Clear	83	81	taken.	58	taken.
	1400	Clear	78	80		58	
	1600	Clear	62	66		55	
12/6/79	1100	Clear	88	88	No reading	46	No reading
	1300	Clear	95	94	taken.	55	taken.
12/7/79	0810	Clear	44	46		39	
	1000	Clear	86	84	No reading	48	No reading
	1230	Clear	98	100		54	
	1440	Clear	88	91	taken.	58	taken.
	1600	Clear	62	64		59	