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Appendices

Appendix 1

Certificate No. : 943192

THE CERTIFICATE OF PATENTS

Patent's name : Fruit fly's Ridding System
Inventor(s) Name : Liang Guang-Qin, Liang Fan, Hu Xue-Nan, Liu Wei, Huang Pin
Patent's No. : ZL 200620063591.8
Date of Application : 30-08-2006
Applicant(s) Name : Liang Guang-Qin
Date of Approval : 05-09-2007

This patent was conferred and registered after being investigated according to the Patent's Act of the Republic of China. This patent is effective from the approval date above.

This patent is effective for ten years, starting from the date of application. The applicant(s) is subjected to the conditions of the Patent's Act, including the submission of annual fees. The dateline for the annual fees submission is by the 30th of August. The granted authorization will be terminated for those who fail to do so.

Terms and conditions of the patent's registration are recorded in the Certificate of Patents. The matters of transfer, mortgage, invalidation, termination, restoration, and changes to the applicant(s) name, nationality, address etc. are recorded in the patent's registration.

Head
Department of National Intellectual Properties
Republic of China

TIAN LI-PU

FRUIT FLY'S RIDDING SYSTEM

Meanwhile, the Fruit fly's Ridding System also consists of one temperature fluctuation recorder and at least one fruit's temperature probes in the fruit's filling container. For instance, four temperature probes were randomly inserted into four fruits in order to measure the temperature changes in that particular batch of fruits.

On the other hand, the hot water treatment pool is built using heat preservation materials. The inlet for hot water is installed at the mid-upper section while the inlet for cold water is installed at the bottom section of the pool. Meshes are also being built on the fruit's filling container. When the container is submerged in hot water, the top part is located slightly higher than the inlet for hot water.

In order to increase the efficiency of the Fruit fly's Ridding System, two or more hot water treatment pool can be utilized, with separate heating system for each pool. Optionally, two or more heating system can be used in one treatment pool or one heating system is shared by more than one treatment pool. Typically, each heating system consists of an automated temperature controlling device. For instance, four treatment pools consist of four heating systems, with two heaters controlled by one temperature controlling system. Optionally, the size of the treatment pool may be twice the size of the typical one.

The programmed temperature will be the temperature that kills the fruit fly and its larvae without damaging (scalding) the fruits. Typically, this temperature is set between 40 – 50 °C (for instance 46 – 47 °C). The temperature is set based on different treated fruits and the targeted pests.

Basically, the heating system is equipped with electrode bar and heating device, based on the vacuum heating concept. It heats the cold water which flows through it to the desired temperature in a short time. In other words, it provides water of programmed temperature whenever needed.

Appendix 2: Eksotika II papaya core temperature is being monitored using a thermometer



Appendix 3: Immature fruit of Eksotika II papaya.



Appendix 4: L*a*/b* values against days after harvest of hot water treated and untreated Eksotika II papaya fruit harvested at different maturity stages during ripening.

Days After Harvest	L*a*/b* Value					
	Untreated			Treated		
	H1	H2	H3	H1	H2	H3
1	-28.97±0.5	-22.52±0.2	-15.43±1.9	-28.77±1.4	-22.89±1.5	-15.37±2.1
3	-27.75±0.5	-18.78±0.7	-2.40±2.1	-27.54±0.1	-18.99±0.9	-2.72±1.2
5	-24.27±0.2	-9.41±1.4	0.42±2.2	-25.03±0.9	-12.14±1.4	0.32±2.4
7	-23.24±0.8	-5.29±0.9	5.70±1.8	-22.04±1.3	-7.38±0.5	5.03±0.3
9	-17.03±1.0	-3.98±0.7	-	-17.79±1.2	-4.24±2.1	-
10	-13.62±0.2	-0.61±1.8	-	-15.07±0.9	-0.32±0.9	-
15	-5.41±1.1	-	-	-6.86±3.7	-	-

Values are mean (n=5) ± standard errors.

Appendix 5: L*a*/b* value against ripening stages of hot water treated and untreated Eksotika II papaya fruit harvested at different maturity stages during ripening.

Ripening Stage	L*a*/b* Value					
	Untreated			Treated		
	H1	H2	H3	H1	H2	H3
Index 1	-28.97±0.5	-	-	-28.77±0.5	-	-
Index 2	-24.14±0.2	-22.52±0.2	-	-23.54±0.2	-22.89±0.2	-
Index 3	-16.51±1.5	-14.83±1.5	-15.43±1.9	-17.40±1.5	-13.87±1.5	-15.37±1.9
Index 4	-4.49±0.5	-4.11±1.8	-2.47±2.1	-7.35±0.5	-3.90±1.8	-3.59±2.1
Index 5	-	-0.52±0.3	7.78±3.3	-	3.10±0.3	6.82±3.3

Values are mean (n=5) ± standard errors.

Appendix 6: Weight loss percentage of hot water treated and untreated Eksotika II papaya fruit harvested at different maturity stages during ripening.

Days After Harvest	Weight Loss (%)					
	Untreated			Treated		
	H1	H2	H3	H1	H2	H3
1	0	0	0	0	0	0
3	2.25±0.1	2.13±0.2	2.12±0.1	1.91±0.1	2.01±0.2	1.98±0.1
5	5.05±0.3	4.24±0.4	4.95±0.2	4.69±0.2	4.79±0.4	4.76±0.1
7	7.88±0.6	7.38±0.6	-	7.22±0.3	7.78±0.7	-
9	8.98±0.7	8.73±0.6	-	8.46±0.5	-	-
10	10.23±0.7	10.47±0.7	-	9.83±0.6	-	-
11	11.39±0.8	-	-	11.16±0.8	-	-

Values are mean (n=5) ± standard errors.

Appendix 7: Pulp firmness of hot water treated and untreated Eksotika II papaya fruit harvested at different maturity stages during ripening.

Ripening Stage	Pulp Firmness (Kgf)					
	Untreated			Treated		
	H1	H2	H3	H1	H2	H3
Index 1	0.97±0.003	-	-	0.97±0.005	-	-
Index 2	0.68±0.080	0.97±0.005	-	0.74±0.061	0.96±0.008	-
Index 3	0.30±0.028	0.32±0.055	0.31±0.046	0.44±0.048	0.55±0.059	0.45±0.062
Index 4	0.15±0.017	0.29±0.029	0.28±0.015	0.44±0.028	0.29±0.020	0.44±0.065
Index 5	-	0.23±0.037	0.22±0.020	-	0.24±0.029	0.23±0.048

Values are mean (n=5) ± standard errors.

Appendix 8: pH of hot water treated and untreated Eksotika II papaya fruit harvested at different maturity stages during ripening.

Ripening Stage	pH Value					
	Untreated			Treated		
	H1	H2	H3	H1	H2	H3
Index 1	5.5 ± 0.06	-	-	5.5 ± 0.09	-	-
Index 2	5.4 ± 0.21	5.6 ± 0.09	-	5.4 ± 0.10	5.5 ± 0.03	-
Index 3	5.4 ± 0.09	5.3 ± 0.06	5.2 ± 0.03	5.4 ± 0.03	5.3 ± 0.00	5.3 ± 0.03
Index 4	5.4 ± 0.11	5.2 ± 0.03	5.3 ± 0.03	5.3 ± 0.04	5.3 ± 0.03	5.3 ± 0.06
Index 5	-	5.2 ± 0.13	5.3 ± 0.07	-	5.2 ± 0.06	5.4 ± 0.03

Values are mean (n=5) ± standard errors.

Appendix 9: TSS value of hot water treated and untreated Eksotika II papaya fruit harvested at different maturity stages during ripening.

Ripening Stage	TSS Value					
	Untreated			Treated		
	H1	H2	H3	H1	H2	H3
Index 1	9.27±0.3	-	-	9.30±0.3	-	-
Index 2	10.00±0.3	12.67±0.2	-	9.60±0.3	12.43±0.0	-
Index 3	9.03±0.3	12.27±0.3	11.70±0.1	10.17±0.7	12.47±0.2	12.37±0.1
Index 4	9.90±0.2	12.40±0.1	13.10±0.2	10.63±0.2	12.00±0.3	13.70±0.3
Index 5	-	12.20±0.2	13.50±0.2	-	12.20±0.2	12.57±0.5

Values are mean (n=5) ± standard errors.

Appendix 10: Fv/Fm values of hot water treated and untreated Eksotika II papaya fruit harvested at different maturity stages during ripening.

Ripening Stage	Fv/Fm Value					
	Untreated			Treated		
	H1	H2	H3	H1	H2	H3
Index 1	0.84±0.004	-	-	0.59±0.02	-	-
Index 2	0.83±0.01	0.84±0.004	-	0.76±0.01	0.68±0.01	-
Index 3	0.80±0.02	0.82±0.02	0.83±0.02	0.73±0.02	0.70±0.02	0.51±0.02
Index 4	0.78±0.01	0.73±0.03	0.71±0.03	0.67±0.05	0.62±0.01	0.68±0.01
Index 5	-	0.72±0.01	0.67±0.03	-	0.54±0.06	0.66±0.04

Values are mean (n=10) ± standard errors.

Appendix 11: Fo, Fm and Fv values of hot water treated and untreated Eksotika II papaya fruit harvested at Index 1 (H1) during ripening.

Ripening Stage	Fo, Fm and Fv value of H1 fruit (Chlorophyll fluorescence relative unit)					
	Untreated			Treated		
	Fo	Fm	Fv	Fo	Fm	Fv
Index 1	646±19	4030±26	3384±14	1106±68	2721±86	1615±90
Index 2	663±30	3878±101	3215±84	826±80	3425±261	2599±198
Index 3	723±47	3785±259	3062±257	998±94	3725±105	2727±72
Index 4	494±36	2275±229	1780±195	761±85	2552±424	1791±352

Values are mean (n=10) ± standard errors.

Appendix 12: Fo, Fm and Fv values of hot water treated and untreated Eksotika II papaya fruit harvested at Index 2 (H2) during ripening.

Ripening Stage	Fo, Fm and Fv value of H2 fruit (Chlorophyll fluorescence relative unit)					
	Untreated			Treated		
	Fo	Fm	Fv	Fo	Fm	Fv
Index 2	649±25	3926±73	3277±49	962±18	2971±106	2008±89
Index 3	614±86	3373±221	2759±205	890±64	3037±232	2146±191
Index 4	546±89	2112±363	1566±291	818±102	2179±285	1361±187
Index 5	622±99	2292±422	1670±328	525±136	1149±241	625±145

Values are mean (n=10) ± standard errors.

Appendix 13: Fo, Fm and Fv values of hot water treated and untreated Eksotika II papaya fruit harvested at Index 3 (H3) during ripening.

Ripening Stage	Fo, Fm and Fv value of H3 fruit (Chlorophyll fluorescence relative unit)					
	Untreated			Treated		
	Fo	Fm	Fv	Fo	Fm	Fv
Index 3	477±85	2651±295	2173±219	966±86	1959±107	994±52
Index 4	609±179	1973±439	1364±296	586±108	1831±344	1245±241
Index 5	271±95	952±423	681±334	127±25	397±77	269±57

Values are mean (n=10) ± standard errors.

Appendix 14: Total sugar, total reducing sugar and total non-reducing sugar content in hot water treated and untreated Eksotika II papaya fruit harvested at different maturity stages during ripening.

Ripening Stage		H1			H2			H3		
		Total Sugar	Total Reducing Sugar	Total Non-Reducing Sugar	Total Sugar	Total Reducing Sugar	Total Non-Reducing Sugar	Total Sugar	Total Reducing Sugar	Total Non-Reducing Sugar
mg / g FW										
Index 1	Untreated	46.14 ± 0.8	14.29 ± 0.7	31.85 ± 1.5	-	-	-	-	-	-
	Treated	44.38 ± 0.3	15.51 ± 1.7	28.87 ± 1.9	-	-	-	-	-	-
Index 2	Untreated	45.52 ± 1.5	17.95 ± 1.8	27.56 ± 2.1	59.06 ± 1.6	14.16 ± 0.3	44.89 ± 1.3	-	-	-
	Treated	45.80 ± 1.2	26.20 ± 0.7	19.60 ± 0.6	56.67 ± 0.6	14.99 ± 0.6	41.68 ± 1.1	-	-	-
Index 3	Untreated	43.88 ± 0.3	21.53 ± 0.2	22.35 ± 0.4	67.39 ± 1.2	16.64 ± 0.6	50.75 ± 1.3	69.98 ± 1.9	16.47 ± 1.3	53.52 ± 1.5
	Treated	45.40 ± 0.6	21.32 ± 0.3	24.07 ± 0.6	67.77 ± 1.3	17.56 ± 1.7	50.22 ± 2.4	67.87 ± 0.7	15.62 ± 2.9	52.25 ± 3.6
Index 4	Untreated	52.40 ± 0.7	18.19 ± 0.3	34.21 ± 0.9	65.56 ± 2.1	18.53 ± 1.2	47.03 ± 2.8	69.54 ± 3.6	21.60 ± 1.2	47.94 ± 4.4
	Treated	52.44 ± 0.1	18.40 ± 0.2	34.04 ± 0.2	64.16 ± 1.1	18.19 ± 1.0	45.97 ± 0.6	67.13 ± 3.3	20.65 ± 1.7	46.47 ± 2.7
Index 5	Untreated	-	-	-	61.67 ± 0.9	18.26 ± 1.9	44.40 ± 1.4	63.13 ± 1.2	19.01 ± 1.7	44.12 ± 1.2
	Treated	-	-	-	62.19 ± 0.4	17.62 ± 0.7	44.57 ± 1.0	64.85 ± 1.6	20.16 ± 2.2	44.69 ± 1.4

Values are mean (n=9) ± standard errors.

Appendix 15: Total protein value of hot water treated and untreated Eksotika II papaya fruit harvested at different maturity stages during ripening.

Ripening Stage	Total Protein (mg/g FW)					
	Untreated			Treated		
	H1	H2	H3	H1	H2	H3
Index 1	1.90±0.02			1.72±0.03		
Index 2	1.95±0.05	2.17±0.02		2.11±0.03	2.47±0.01	
Index 3	1.93±0.02	2.14±0.03	2.75±0.04	2.33±0.02	2.52±0.06	1.98±0.06
Index 4	2.08±0.02	2.16±0.01	2.53±0.07	2.00±0.02	2.19±0.01	2.04±0.05
Index 5		2.99±0.02	3.49±0.06		2.58±0.01	2.53±0.09

Values are mean (n=9) ± standard errors.

Appendix 16: Pectin methylesterase activity of hot water treated and untreated Eksotika II papaya fruit harvested at different maturity stages during ripening.

Ripening Stage	Pectin Methylesterase Activity (Units/mg protein)					
	Untreated			Treated		
	H1	H2	H3	H1	H2	H3
Index 1	31.75±0.8	-	-	48.91±0.9	-	-
Index 2	23.61±0.8	29.99±0.7	-	26.33±0.8	21.85±0.6	-
Index 3	13.98±0.8	9.64±0.7	9.81±0.6	14.99±1.4	7.56±1.1	44.09±0.8
Index 4	7.63±1.5	12.49±0.7	6.90±0.6	11.90±0.0	7.97±0.7	24.12±0.8
Index 5	-	1.59±0.5	1.82±0.5	-	5.54±0.3	7.53±0.4

Values are mean (n=9) ± standard errors.

Appendix 17: Polygalacturonase activity of hot water treated and untreated Eksotika II papaya fruit harvested at different maturity stages during ripening.

Ripening Stage	Polygalacturonase Activity (Units/mg protein)					
	Untreated			Treated		
	H1	H2	H3	H1	H2	H3
Index 1	33.33±1.3	-	-	24.07±0.0	-	-
Index 2	48.52±0.8	34.26±2.5	-	14.65±0.0	34.12±2.2	-
Index 3	147.48±0.8	142.38±4.8	120.41±4.6	97.83±0.6	142.02±2.5	41.58±4.2
Index 4	132.46±0.7	119.91±4.8	182.26±3.4	113.69±2.1	98.33±1.9	25.86±2.0
Index 5	-	64.67±3.6	71.75±4.5	-	63.43±2.0	72.22±3.4

Values are mean (n=9) ± standard errors.

Appendix 18: Pectate lyase activity of hot water treated and untreated Eksotika II papaya fruit harvested at different maturity stages during ripening.

Ripening Stage	Pectate Lyase Activity (Units/mg protein)					
	Untreated			Treated		
	H1	H2	H3	H1	H2	H3
Index 1	0.105±0.002			0.098±0.002		
Index 2	0.118±0.001	0.147±0.002		0.087±0.001	0.027±0.001	
Index 3	0.306±0.002	0.267±0.002	0.265±0.002	0.027±0.001	0.053±0.001	0.023±0.002
Index 4	0.288±0.002	0.266±0.004	0.264 ±0.001	0.027±0.002	0.021±0.003	0.032±0.003
Index 5		0.143±0.001	0.233 ±0.003		0.036±0.003	0.002±0.000

Values are mean (n=9) ± standard errors.

Appendix 19: Cellulase activity of hot water treated and untreated Eksotika II papaya fruit harvested at different maturity stages during ripening.

Ripening Stage	Cellulase Activity (μg glucose/mg protein/h)					
	Untreated			Treated		
	H1	H2	H3	H1	H2	H3
Index 1	40.38 \pm 1.2			25.26 \pm 2.6		
Index 2	98.09 \pm 2.2	182.58 \pm 3.0		95.56 \pm 1.2	167.97 \pm 2.2	
Index 3	179.89 \pm 6.4	191.16 \pm 3.2	217.09 \pm 10.3	156.12 \pm 1.6	173.91 \pm 2.2	191.05 \pm 1.1
Index 4	224.42 \pm 5.9	246.50 \pm 5.6	257.34 \pm 2.0	218.13 \pm 1.8	209.83 \pm 2.0	198.98 \pm 4.0
Index 5		260.94 \pm 1.4	265.74 \pm 3.0		223.96 \pm 4.0	141.52 \pm 5.0

Values are mean (n=9) \pm standard errors.