PLASTOFLEX 71

FROST PROTECTION WITH PARAFFIN CANDLE

Technological Description

Paraffin candles are suitable for protecting against spring frosts. The anti-frost candles are filled in 6-litre metal cans and the additives ensure burning and warm smoke for up to 10 to 12 hours.

Every fruit tree has a critical temperature value in the respective phenological phases which it the tree can endure without damage. In view of this critical temperature, the tasks are determined by a person responsible. *(Annex 1.)*.

1. Planning Frost Protection

A. Use a sufficient amount of anti-frost candles
– Necessary amount: 350-500 pcs. per hectare
– Prepare an installation plan

B. Purchase and install of meteorological devices
– Install meteorological stations or thermometers n in the protected area as well as to the control area.

C. Ensure the sufficient number of personnel for the ignition
– 1 to 1.5 person/ha as well as 1 to 2 people to distribute the candles and organise the work.
– A night shift schedule, an emergency and action plan are necessary.

2. Preparation for Frost Protection

A. Acquire and prepare ignition tools
– Ignition can be done with a jerry can, a big blow torch, or a small blow torch which comply with safety regulations.
– The acquisition and preparation of ignition mixture and other materials for the ignition.
– The purchase of an ignition tool (lighter)

B. Installation of anti-frost candles
– Installation based on plan. *(1.A.)*
– Finish the installation of candles at the beginning of the frost susceptible period the latest.
– A candle must be installed in front of the first and behind the last trees of the rows, as well.
– Do not place candles next to trees and to the irrigation pipes! Do not put them in a highly flammable place!

C. Remove the lids of anti-frost candles
– Lids must be removed by the beginning of the frost susceptible period, before the ignition.
– Half of the anti-frost candles should be prepared for the ignition (every candle of every second row or every second candle of each row.)
– The lids must be placed close to the candles because they will be necessary for the extinguishing. *(4.A.)*

D. Introduce OSH training and train workers who are taking part in the frost protection

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3. The beginning of frost protection and ignition of candles

A. The person in charge alerts the workers *(1.C.)*
If the temperature is falling suddenly and largely such as 1 Celsius/hour, the person in charge must start the alert (During sunset temperature is falling suddenly. This is a natural phenomenon.).

B. Ignition of candles
Figures in the chart *(Annex 1. and Annex 2.)* are normative but can be varied in cultivars and varieties: If the temperature reaches a harmful value in a short period of time, the ignition of the candles must be started.

– ***First Round:*** Ignite every second candle in every second row, as well as the first and last candles of these rows. (This represent around 25% of the candles, if 450-500 pcs. /ha is used.) If the temperature does not rise, or the control area's *(B.1)* temperature drops below the value temperature of 10% loss, it is necessary to light up more candles.

– ***Second Round:*** Ignite all the remaining candles in the rows already ignited, or every second candle of the rows which have not been ignited yet. (around 50% of the candles, if 450-500 pcs. /ha is used). If the temperature does not rise or the control area's *(B.1)* temperature reaches minus 5 Celsius (-5°C), all the candles must be lit up (Third round, but if it seems necessary this should be done during the second round.)

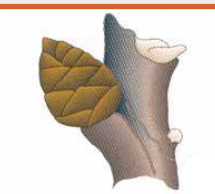
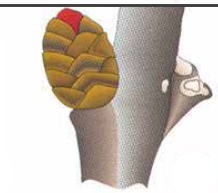
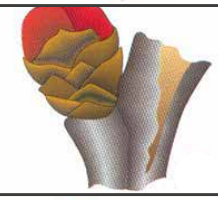
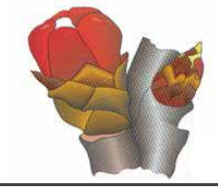
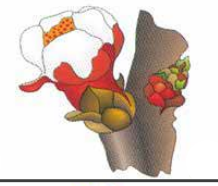
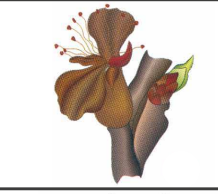
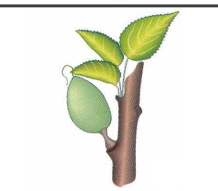
– ***Third Round:*** It is advisable to start in the most frost susceptible area, and if it is possible the direction of the ignition should follow the airflow. The time factor is important: all the required number of candles must be lit within one hour from the ordainment of the ignition. *(1.C.)* If half of the candles are lit (after the ignition of the second round *(3.B.)*), it is advisable to remove the lids of the anti-frost candles to prepare them for the next ignition! *(2.C.)*

4. Extinguishing the anti-frost candles, preparing for the next frost period

A. Put back the lids onto the anti-frost candles to extinguish the fire

B. Check the paraffin level in the candles
– The left-hand side candle (not used) is able to burn 10 to 12 hours, whereas the right-hand side in one (half-way burnt, as it is apparent on the outside), can only burn up to 5 to 6 hours.
– Replace the burned candles if it is necessary. *(1.A)*
– Replace used ignition mixture and necessary materials for the ignition. *(2.A.)*
– Plan the next ignition considering the state of the candles.

Annex 1. The critical temperature value of the apricot by phenological phase

Phase	Phase Illustration	Critical Temperature	10% harm	90% harm
Winter Bud		-	- 9,4°C	-
Bud Swelling		- 4°C	-	-
Red Bud		- 4°C	- 6,2°C	- 13,8°C
White Bud		- 3,5°C	- 4,9°C	- 10,3°C
Start of the opening		- 3°C	- 4,3°C	- 10,1°C
Main Blooming		- 2,2°C	- 2,9°C	- 5,6°C
Petal Falling		- 0,8°C	-	-
Young Fruit with flower left		- 0,5°C	- 2,6°C	- 4,4°C
Young Fruit		- 0,5°C	- 2,3°C	- 3,3°C

Annex 2. Fruit cultivars critical temperature values

		Peach/ Nectarine	Apricot	Cherry	Plum	Sour Cherry	Apple	Pear
		Temperature (Celsius)						
Red bud/ Green bud	Critical Temperature	- 4	- 3,5	- 3,5	- 4	- 4	- 4	- 6
	10%	- 6,1	- 4,9	- 3,7	- 6,6	- 5,6	- 7	- 6,7
	90%	- 15	- 10,3	- 6,2	- 13,9	- 9,5	- 12	- 14,4
White bud	Critical Temperature	- 2,8	- 3	- 2,2	- 2,8	- 2	- 2	- 2,8
	10%	- 3,3	- 4,3	- 2,7	- 2,8	- 2,2	- 2,2	- 3,3
	90%	- 5,6	- 10,1	- 4,9	- 5	- 4,4	- 4	- 5,6
Open flower	Critical Temperature	- 2,2	- 2,2	- 1,1	- 2	- 2	- 1,8	- 1,6
	10%	- 2,7	- 2,9	- 2,1	- 2,2	- 2,2	- 2,2	- 2,2
	90%	- 4,4	- 5,6	- 3,6	- 5	- 4,4	- 3,9	- 4,4
Petal flower	Critical Temperature	- 1,8	- 0,8	- 1,1	- 1,5	- 2	- 1,6	- 1,5
	10%	- 2,2	- 2,7	- 2,1	- 2,1	- 2,2	- 2,2	- 2,2
	90%	- 3,9	- 3,6	- 3,6	- 5	- 4,4	- 3,8	- 4,4
Small fruit	Critical Temperature	- 1	- 0,5	- 1	- 1 (- 0,5)	- 1,5	- 1,6	- 1
	10%		- 2,3				- 2,2	
	90%		- 3,3				- 3,8	

Annex 3. Recommendation of usage

TEMPERATURE	- 2 °C	- 3 °C	- 4 °C	- 5 °C	- 6 °C	- 7 °C
Nº of necessary candles/ha	200	250	300	350	400	500