Design of Plant Care Expert System for Cucumber

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# Table of Content

1. **INTRODUCTION** ................................................................. 2  

2. **DOMAIN KNOWLEDGE** ...................................................... 2  
   2.1 **DOMAIN ONTOLOGY** ......................................................... 2  
   2.2 **DOMAIN MODEL** .............................................................. 10  

3. **INFERENCE KNOWLEDGE** .................................................. 56  
   2.3 **INFERENCE STRUCTURE** ................................................... 56  
   2.4 **INFERENCE SPECIFICATION** ............................................ 57  

4. **TASK KNOWLEDGE** .......................................................... 58  

5. **USER INTERFACE** ............................................................ 59  
   5.1 **INPUT** ..................................................................... 59  
   5.2 **OUTPUT** .................................................................. 59  

6. **TEST CASES** ................................................................... 60  

**APPENDIX** ....................................................................... 65
1. Introduction
This report explains the detailed design of plant care subsystem in the cucumber under plastic tunnel expert system. The main goal of developing this new version is to develop it under windows environment. Consequently this version is based on earlier versions of CUPTEX expert systems (TR-88-024-43) titled with "Detailed Design of The Cucumber Production Management Under Plastic Tunnel Expert Systems (CUPTEX) Version 3.0.", the Amendment of Treatment & Plant Care Subsystems of CUPTEX, (TR-88-024-48), and the different between the implantation and the design (the appendix of this report).

2. Domain Knowledge

2.1 Domain Ontology
The domain ontology defines the terms that can be used in the domain (domain terms), and the knowledge types that these terms have (domain typology, e.g., concept, attribute, value, relation).

concept plantation;
properties:
  mulch-used :yes,no (نعم، لا)
        source of value: user⁴
    cardinality: single

  area: numeric
        source of value: user⁴
    cardinality: single

  date: date
        source of value: user⁴ database
    cardinality: single

  drainage-system: medium;bad (متوسط، سيء)
        source of value: user⁴ database
    cardinality: single

  plastic-age :numeric
        source of value: user⁴
    cardinality: single

  after-cult-period : date
source of value: derived
cardinality: single

before-cult-period: date
source of value: derived
cardinality: single

soil_sterilization: not_exist, exist
(source of value: user
cardinality: single

concept appearance;
properties:
weed_exist: yes, no
(source of value: user
cardinality: single

previous_crop_remainder: yes, no
(source of value: user
cardinality: single

concept soil;
properties:
type: fine, medium, coarse
(source of value: user database
cardinality: single

ce: numeric
(source of value: user database
cardinality: single

soil_steri_will_use1 = 'methyle bromide'; bazamide; solarization
(source of value: user
(cardinality: single

soil_steri_will_use2 = 'methyle bromide'; bazamide
(source of value: user
(cardinality: single

concept climate;
properties:
wind = yes, no
(source of value: user
(cardinality: single

avg-tec: numeric
source of value: user† database
cardinality: single

concept plant;
properties:
  season = 'early autumn','late autumn', winter, spring, 'early summer', 'late summer
source of value: user†
cardinality: single

rd : numeric
source of value: derived†
cardinality: single

current-month: numeric
source of value: user†
cardinality: single

early_production: yes, no (لمع, نعم)
source of value: user†
cardinality: single

concept Irrigation;
properties:
  quantity-first-leaching = numeric
  source of value: derived†
cardinality: single

quantity-second-leaching: numeric
source of value: derived†
cardinality: single

quantity-third-leaching: numeric
source of value: derived†
cardinality: single

concept Last-infection;
properties:
  nematode-exist: {yes, no} (نعم, لمع)
  source of value: user†
cardinality: single†

  fungal-exist: {yes, no} (نعم, لمع)
  source of value: user†
cardinality: single†
analysis-fungal: yes;no (نعم،لا)
   source of value: user
   cardinality: single

analysis-fungal-status: high, medium, low, not exist
(لا يوجد، منخفض، متوسط، عالي)
   source of value: user
   cardinality: single

fungal-status-last-season: high, medium, low
(منخفض، متوسط، عالي)
   source of value: user
   cardinality: single

analysis-nematode: yes; no (نعم،لا)
   source of value: user
   cardinality: single

analysis-nematode-status: high, medium, low, not exist
(لا يوجد، منخفض، متوسط، عالي)
   source of value: user
   cardinality: single

nematode-status-last-season: high, medium, low
(منخفض، متوسط، عالي)
   source of value: user
   cardinality: single

type-of-nematode-analysis: root knot nematode, other nematode
(أنواع أخرى، نباتات تغير الجذور)
   source of value: user
   cardinality: single

**concept** operation;

**properties:**
   status: suggest
      source of value: derived
      cardinality: single

   pc-number: number
      source of value: derived
      cardinality: single

   advice: string
      source of value: derived
      cardinality: single
application-time: "during day, three hours before sunset",
"avoid-high-temperature-during-spraying"

source of value: derived
cardinality: single

material-name: vydate (liquid), topsin, benlate, trimeltox-fort

source of value: derived
cardinality: single

material-qty: number
source of value: derived
cardinality: single

material-unit: number
source of value: derived
cardinality: single

method_perform: string
source of value: derived
cardinality: single

method: soil drench, foliar application

(source of value: derived
cardinality: single)

tool: irrigation system, sprayer, duster

(source of value: derived
cardinality: single)

concept nematode_op
sub-type-of: operation

concept fungal_op
sub-type-of: operation

concept downy-mildew_op
sub-type-of: operation

concept Fungi_spiders_op
sub-type-of: operation
concept plastic-tunnel-sterilization
sub-type-of: operation

concept defer_irrigation_date
sub-type-of: operation

concept cultivate-maize
sub-type-of: operation

concept spraying-the-nursery-before-transplanting
sub-type-of: operation

concept painting-the-plastic-cover
sub-type-of: operation

concept waching-the-plastic-cover
sub-type-of: operation

concept avoid-late-irrigation
sub-type-of: operation

concept avoid-afternoon-spraying
sub-type-of: operation

concept waching-the-nets
sub-type-of: operation

concept install-drainge-system
sub-type-of: operation

concept getting-rid-of-previous-crop
sub-type-of: operation

concept collect-irrigation-lines
sub-type-of: operation

concept plowing
sub-type-of: operation

concept basins
sub-type-of: operation

concept first-leaching
sub-type-of: operation
concept adding-organic-manure
sub-type-of: operation

concept adding-chemical-fertilizers
sub-type-of: operation

concept ridging
sub-type-of: operation

concept second-leaching
sub-type-of: operation

concept plastic-tunnel-disinfection
sub-type-of: operation

concept irrigation-system-establishment
sub-type-of: operation

concept washing-and-testing-the-irrigation-system
sub-type-of: operation

concept installing-nets
sub-type-of: operation

concept irrigation-to-field-capacity
sub-type-of: operation

concept transplanting
sub-type-of: operation

concept plant-protection-after-transplanting
sub-type-of: operation

concept ventilation
sub-type-of: operation

concept pruning-and-training
sub-type-of: operation

concept avoid-high-soil-moisture
sub-type-of: operation

concept removing-weeds
sub-type-of: operation

concept Mulching
sub-type-of: operation

concept painting-the-plastic-cover
sub-type-of: operation

concept third-leaching_
  sub-type-of: operation

concept germination-test
sub-type-of: operation

concept get_ride_of_sand_or_dust
sub-type-of: operation

concept rottary-plowing
sub-type-of: operation

concept ditching
sub-type-of: operation

concept adding-gypsum
sub-type-of: operation

concept adding-sulpher
sub-type-of: operation

concept disinfection_of_plants_and_plastic
sub-type-of: operation
2.2 Domain Model

domain-model: determine model;
  parts: tuple(determine);

axioms:
  plantation:date > :current-date
determine
  plantation:before-cult-period= Plantation:date - current-date

  plantation:date<= current-date
determine
  Plantation:after-cult-period=current-date - Plantation:date
  plantation:before-cult-period=0

domain-model: suggestion model;
  parts: tuple(suggest);

axioms:
  plantation:before-cult-period>0
  Suggest
  Irrigation:quantity-first-leaching = (1.5 * (0.15 + 1/ (5*2/soil:ec)) * plant:rd *
  plantation:area)

  plantation:before-cult-period>0
  Suggest
  Irrigation:quantity-second-leaching = irrigation:quantity-first-leaching * 1.5

  plantation:before-cult-period>0
  Suggest
  Irrigation:quantity-third-leaching = irrigation:quantity-first-leaching * 1.5

  plantation:before-cult-period>0
  plantation: soil_sterilization= not_exist
  last_infection:nematode-exist=yes
  last_infection:analysis-nematode=yes
  last_infection:analysis-nematode-status=low
  (last_infection:fungle-exist=no;
   (last_infection:fungle-exist=yes ,last_infection:analysis-fungal=yes
    last_infection:analysis-fungal-status=low)
   )
  Suggest
  Nematode_op:status=suggest

  plantation:before-cult-period>0
  plantation: soil_sterilization= not_exist
  last_infection:nematode-exist=yes
last_infection:analysis-nematode=yes
last_infection:analysis-nematode-status= not(low)
last_infection:type-of-nematode-analysis='other nematode'
(last_infection:fungle-exist=no;
   (last_infection:fungle-exist=yes,last_infection:analysis-fungal=yes
    last_infection:analysis-fungal-status=low)
)

Suggest
Nematode_op:status=suggest

plantation:before-cult-period>0
plantation: soil_ sterilization= not_exist
last_infection:fugal-exist=not_exist
last_infection:analysis-fungal=not_exist
last_infection:analysis-fungal-status=low
last_infection:nematode-exist=yes
(last_infection:analysis-nematode-status= low;
   (last_infection:analysis-nematode-status=not(low),last_infection:type-of-
    nematode-analysis='other nematode')
)

Suggest
fungal_op:status=suggest

plantation:before-cult-period>0
plantation: soil_ sterilization= not_exist
last_infection:fugal-exist=not_exist
last_infection:analysis-fungal=not_exist
last_infection:analysis-fungal-status=low
last_infection:nematode-exist=no

Suggest
fungal_op:status=suggest
plantation:before-cult-period=<0
plantation: soil_ sterilization= not_exist

plantation:after-cult-period=< 10
last_infection: nematoda-exist=yes

Suggest
nematoda_op:status=suggest

plantation:before-cult-period=<0
plantation: soil_ sterilization= not_exist
plantation:after-cult-period=< 14
last_infection:soil-sterilization='not exist'
last_infection:nematode-exist=yes

Suggest
nematode_op:status=suggest
plant:season='early autumn';'late autumn';winter;spring
          Suggest
downy-mildew_op:status=suggest

plant:season='early autumn';'late autumn';winter;spring; 'early summer';'late summer
          Suggest
Fungi_spiders_op:status=suggest

Plantation:soil_sterilization = 'not exist',
soil:type = fine ; medium
plantation:before_cult_period >= 45,
last_infection:nematode_exist = yes,
last_infection:analysis_nematode= no,
soil:soil_steri_will_use2 = 'methyle bromide' ; bazamide
          Suggest
plastic-tunnel-sterilization: status  = suggested

plantation: soil_sterilization = 'not exist',
soil:type = fine ; medium
plantation :before_cult_period>= 45,
last_infection:nematode_exist = yes,
last_infection:analysis_nematode= yes,
last_infection:analysis_nematode_status = medium,
last_infection:type_of_nematode_analysis = root_knot_nematode,
soil:soil_steri_will_use1= 'methyle bromide' ; bazamide; solarization
          Suggest
plastic-tunnel-sterilization: status  = suggested

plantation: soil_sterilization = 'not exist',
soil:type = fine ; medium
plantation :before_cult_period>= 45,
last_infection:nematode_exist = yes,
last_infection :analysis_nematode= yes,
last_infection:analysis_nematode_status = high,
last_infection:type_of_nematode_analysis = root_knot_nematode,
soil:soil_steri_will_use1= 'methyle bromide' ; bazamide
          Suggest
plastic-tunnel-sterilization: status  = suggested
plantation: soil_sterilization = 'not exist',
soil:type = fine ; medium
plantation :before_cult_period>= 45,
last_infection :fungal_exist= yes,
(last_infection:nematode_exist = no

([last_infection :analysis_nematode= yes, last_infection:analysis_nematode_status = low];
(last_infection :analysis_nematode= yes, last_infection:type_of_nematode_analysis = 'other nematode'))

) last_infection :analysis_fungal= yes, (last_infection: analysis_fungal_status = high ;
last_infection: analysis_fungal_status = medium)

plantation :soil_steri_will_use1 = 'methyle bromide' ; bazamide; solarization
Suggest
plastic-tunnel-sterilization: status = suggested

plantation: soil_sterilization = 'not exist',
soil:type = fine ; medium
plantation :before_cult_period>= 45,
last_infection :fungal_exist= yes,
(last_infection:nematode_exist = no ; [
(last_infection :analysis_nematode= yes,
last_infection:analysis_nematode_status = low ) or
(last_infection :analysis_nematode= yes,
last_infection:type_of_nematode_analysis = 'other nematode' )]
),
last_infection :analysis_fungal= no,
soil:soil_steri_will_use1 = 'methyle bromide' ; bazamide; solarization
Suggest
plastic-tunnel-sterilization: status = suggested

plantation: soil_sterilization = 'not exist',
soil:type= coarse,
plantation :before_cult_period>= 21,
last_infection:nematode_exist = yes,
last_infection:analysis_nematode= no,
soil:soil_steri_will_use2 = 'methyle bromide' ; bazamide
Suggest
plastic-tunnel-sterilization: status = suggested

plantation: soil_sterilization = 'not exist',
soil:type= coarse,
plantation :before_cult_period>= 21,
last_infection:nematode_exist = yes,
last_infection :analysis_nematode= yes,
last_infection :analysis_nematode_status = medium,
last_infection:type_of_nematode_analysis = root_knot_nematode,
soil:soil_steri_will_use1 = 'methyle bromide' ; bazamide; solarization
Suggest
plastic-tunnel-sterilization: status = suggested
plantation: soil sterilization = 'not exist',
soil:type= coarse,
plantation :before_cult_period>= 21,
last_infection:nematode_exist = yes,
last_infection :analysis_nematode= yes,
last_infection:analysis_nematode_status = high,
last_infection:type_of_nematode_analysis = root_knot_nematode,
soil:soil_steri_will_use2= 'methyle bromide' ; bazamide
  Suggest
plastic-tunnel-sterilization: status  = suggested

plantation: soil sterilization = 'not exist',
soil:type= coarse,
plantation :before_cult_period>= 21,
last_infection :fungal_exist= yes,
(last_infection:nematode_exist = no or [  
  (last_infection :analysis_nematode= yes,
    last_infection:analysis_nematode_status = low )
  ;
  (last_infection :analysis_nematode= yes,
    last_infection:type_of_nematode_analysis = 'other nematode' )
],
last_infection :analysis_fungal= yes,
(last_infection:analysis_fungal_status = high ;
  last_infection:analysis_fungal_status = medium ),
soil:soil_steri_will_use1= 'methyle bromide' ; bazamide; solarization
  Suggest
plastic-tunnel-sterilization: status  = suggested

plantation: soil sterilization = 'not exist',
soil:type= coarse,
plantation :before_cult_period>= 21,
last_infection :fungal_exist= yes,
(last_infection:nematode_exist = no

; (last_infection :analysis_nematode= yes, last_infection:analysis_nematode_status = low)
; (last_infection :analysis_nematode= yes, last_infection:type_of_nematode_analysis = 'other nematode' )
),
last_infection :analysis_fungal= no,
soil:soil_steri_will_use1= 'methyle bromide' ; bazamide; solarization
  Suggest
plastic-tunnel-sterilization: status  = suggested
plantation: soil_sterilization = 'not exist',
soil:type = fine ; medium
plantation :before_cult_period< 45,
plantation :before_cult_period> 0,
last_infection:nematode_exist = yes,
last_infection :analysis_nematode= no,
soil:soil_steri_will_use2= 'methyle bromide' ; bazamide
Suggest
plastic-tunnel-sterilization: status  = suggested
defer_irrigation_date : status = suggested

plantation: soil_sterilization = 'not exist',
soil:type = fine ; medium
plantation :before_cult_period< 45,
plantation :before_cult_period> 0,
last_infection:nematode_exist = yes,
last_infection :analysis_nematode= yes,
last_infection:analysis_nematode_status = medium,
last_infection:type_of_nematode_analysis = root_knot_nematode,
soil:soil_steri_will_use1= 'methyle bromide' ; bazamide; solarization
Suggest
plastic-tunnel-sterilization: status  = suggested
defer_irrigation_date : status = suggested

plantation: soil_sterilization = 'not exist',
soil:type = fine ; medium
plantation :before_cult_period< 45,
plantation :before_cult_period> 0,
last_infection:nematode_exist = yes,
last_infection :analysis_nematode= yes,
last_infection:analysis_nematode_status = high,
last_infection:type_of_nematode_analysis = root_knot_nematode,
soil:soil_steri_will_use2= 'methyle bromide' ; bazamide
Suggest
plastic-tunnel-sterilization: status  = suggested
defer_irrigation_date : status = suggested

plantation: soil_sterilization = 'not exist',
soil:type = fine ; medium
plantation :before_cult_period< 45,
plantation :before_cult_period> 0,
last_infection:fungal_exist= yes,
(last_infection:nematode_exist = no ;

(last_infection:analysis_nematode= yes, last_infection:analysis_nematode_status = low)
;
(last_infection:analysis_nematode= yes, last_infection:type_of_nematode_analysis = 'other nematode')
);
last_infection:analysis_fungal= yes, (last_infection:analysis_fungal_status = high ; last_infection:analysis_fungal_status = medium ;
),
soil:soil_steri_will_use1 = 'methyle bromide'; bazamide; solarization
  Suggest plastic-tunnel-sterilization: status = suggested
defer_irrigation_date: status = suggested

plantation: soil_sterilization = 'not exist',
soil: type = fine; medium
plantation: before_cult_period < 45,
plantation: before_cult_period > 0,
last_infection: fungal_exist = yes, (last_infection:nematode_exist = no ;
; (last_infection:analysis_nematode= yes, last_infection:analysis_nematode_status = low)
; (last_infection:analysis_nematode= yes, last_infection:type_of_nematode_analysis = 'other nematode')
),
last_infection: analysis_fungal= no,
soil: soil_steri_will_use1 = 'methyle bromide'; bazamide; solarization
  Suggest plastic-tunnel-sterilization: status = suggested
defer_irrigation_date: status = suggested

plantation: soil_sterilization = 'not exist',
soil: type = coarse,
plantation: before_cult_period < 21,
plantation: before_cult_period > 0,
last_infection: nematode_exist = yes,
last_infection: analysis_nematode= no,
soil: soil_steri_will_use2 = 'methyle bromide'; bazamide
  Suggest plastic-tunnel-sterilization: status = suggested
defer_irrigation_date: status = suggested

plantation: soil_sterilization = 'not exist',
soil: type = coarse, plantation: before_cult_period < 21, plantation: before_cult_period > 0, last_infection: nematode_exist = yes, last_infection: analysis_nematode = yes, last_infection: analysis_nematode_status = medium, last_infection: type_of_nematode_analysis = root_knot_nematode, soil: soil_steri_will_use1 = 'methyle bromide'; bazamide; solarization

Suggest
plastic-tunnel-sterilization: status = suggested
defer_irrigation_date: status = suggested

plantation: soil_sterilization = 'not exist', soil: type = coarse, plantation: before_cult_period < 21, plantation: before_cult_period > 0, last_infection: nematode_exist = yes, last_infection: analysis_nematode = yes, last_infection: analysis_nematode_status = high, last_infection: type_of_nematode_analysis = root_knot_nematode, soil: soil_steri_will_use2 = 'methyle bromide'; bazamide

Suggest
plastic-tunnel-sterilization: status = suggested
defer_irrigation_date: status = suggested

plantation: soil_sterilization = 'not exist', soil: type = coarse, plantation: before_cult_period < 21, plantation: before_cult_period > 0, last_infection: fungal_exist = yes, (last_infection: nematode_exist = no)
; (last_infection: analysis_nematode = yes, last_infection: analysis_nematode_status = low)
; (last_infection: analysis_nematode = yes, last_infection: type_of_nematode_analysis = 'other nematode')
), last_infection: analysis_fungal = yes, (last_infection: analysis_fungal_status = high ;
last_infection: analysis_fungal_status = medium ), soil: soil_steri_will_use1 = 'methyle bromide'; bazamide; solarization

Suggest
plastic-tunnel-sterilization: status = suggested
defer_irrigation_date: status = suggested
plantation: soil sterilization = 'not exist', soil:type= coarse, plantation :before_cult_period< 21, plantation :before_cult_period> 0, last_infection :fungal_exist= yes, (last_infection:nematode_exist = no ; (last_infection:analysis_nematode= yes, last_infection:analysis_nematode_status = low) ; (last_infection:analysis_nematode= yes, last_infection:type_of_nematode_analysis = 'other nematode' ) ), last_infection:analysis_fungal= no, soil:soil_steri_will_use1= 'methyle bromide' ; bazamide; solarization Suggest plastic-tunnel-sterilization: status = suggested defer_irrigation_date : status = suggested

plantation:before-cult_period >100 plantation: month(date)=9;10 Plant: current-month=3;4;5;6;7;8 last-infection:nematode-exist =yes SUGGEST cultivate-maize: status = suggested

plantation:before-cult_period >0 nematoda_op:status=suggest SUGGEST spraying-the-nursery-before-transplanting: status = suggested

plant:current-month=4;5 SUGGEST painting-the-plastic-cover: status = suggested

plant:current-month=10;11;12;1;2 SUGGEST waching-the-plastic-cover: status = suggested

plant:current-month=11;12;1;2;3 SUGGEST avoid-late-irrigation : status = suggested avoid-afternoon-spraying: status = suggested

plant:current-month=4;5;6;7;8 SUGGEST
waching-the-nets: status = suggested

plantation: before-cult-period > 0
plantation: drainage-system = medium; bad
    SUGGEST
install-drainge-system: status = suggested

plantation: before-cult-period > 0
    SUGGEST
disinfection_of_plants_and_plastic: status = suggested
collect-irrigation-lines: status = suggested
plowing: status = suggested
basins: status = suggested
first-leaching: status = suggested
adding-organic-manure: status = suggested
adding-chemical-fertilizers: status = suggested
ridging: status = suggested
second-leaching: status = suggested
plastic-tunnel-disinfection: status = suggested
irrigation-system-establishment: status = suggested
washing-and-testing-the-irrigation-system: status = suggested
installing Nets: status = suggested
irrigation-to-field-capacity: status = suggested
transplanting: status = suggested
ventilation: status = suggested
pruning-and-training: status = suggested
avoid-high-soil-moisture: status = suggested

plantation: after-cult-period >= 0
    SUGGEST
ventilation: status = suggested
pruning-and-training: status = suggested
avoid-high-soil-moisture: status = suggested

appearance: previous_crop_remainder = yes
appearance: before-cult-period > 0
    SUGGEST
getting-rid-of-previous-crop: status = suggested

appearance: weed_exist = yes
    SUGGEST
removing-weeds: status = suggested

plantation: before-cult-period > 0
plantation: mulch-used = yes
SUGGEST
Mulching: status = suggested

plant: current-month = 8;9
plantation:plastic-age=0

SUGGEST
painting-the-plastic-cover: status = suggested

plastic-tunnel-sterilization: status = suggested
soil:soil-setri-method-will-use=methyle bromide,bazamide

SUGGEST
third-leaching_germination-test: status = suggested

climate:wind = yes

SUGGEST
get_ride_of_sand_or_dust: status = suggested

plantation:before-cult-period>0
soil:type=medium;fine

SUGGEST
rottery-plowing: status = suggested

plantation:before-cult-period>0
soil:type=coarse

SUGGEST
ditching: status = suggested

plantation:before-cult-period>0
(soil:ec>2 or (soil:ec>2 & soil:ph>7))

SUGGEST
adding-gypsum: status = suggested

plantation:before-cult-period>0
soil:ec =< 2
soil:ph>7

SUGGEST
adding-sulpher: status = suggested
domain-model: assignment model;
  part: tuple(assign);

axioms:
defer-irrigation-date: status = suggested
  ASSIGN
defer-irrigation-date: pc-number=0

disinfection-of-plants-and-plastic: status = suggested
  ASSIGN
disinfection-of-plants-and-plastic: pc-number=1
disinfection-of-plants-and-plastic: method-perform=method (1)

getting-rid-of-previous-crop: status = suggested
  ASSIGN
getting-rid-of-previous-crop: pc-number=2
getting-rid-of-previous-crop: method-perform=method (2)

collect-irrigation-lines: status = suggested
  ASSIGN
collect-irrigation-lines: pc-number=3
collect-irrigation-lines: method-perform=method (3)

install-drainge-system: status = suggested
  ASSIGN
install-drainge-system: pc-number=4
install-drainge-system: method-perform=method (4)

adding-gypsum: status = suggested
  ASSIGN
adding-gypsum: pc-number=5
adding-gypsum: method-perform=mehtod (5)

cultivate-maize: status = suggested
  ASSIGN
cultivate-maize: pc-number=6
cultivate-maize: method-perform=method (6)

plowing: status = suggested
  ASSIGN
plowing: pc-number=7
plowing: method-perform=method (7)

basins: status = suggested
  ASSIGN
plowing:: pc-number=7
first-leaching: status = suggested
  ASSIGN
first-leaching: pc-number=8
first-leaching: method-perform=method (8)

ditching: status = suggested
  ASSIGN
ditching: pc-number=9
ditching: method-perform=method (9)

adding-organic-manure: status = suggested
  ASSIGN
adding-organic-manure: pc-number=10
adding-organic-manure: method-perform = method (10)

adding-chemical-fertilizers: status = suggested
  ASSIGN
adding-chemical-fertilizers: pc-number=11
adding-chemical-fertilizers: method-perform = method (11)

adding-sulpher: status = suggested
  ASSIGN
adding-sulpher: pc-number=12
adding-sulpher: method-perform = method (12)

rotary-plowing: status = suggested
  ASSIGN
rotary-plowing: pc-number=16
rotary-plowing: method-perform = method (14)

ridging: status = suggested
  ASSIGN
ridging: pc-number=17
ridging: method-perform = method (15)

second-leaching: status = suggested
  ASSIGN
second-leaching: pc-number=18
second-leaching: method-perform = method (16)

plastic-tunnel-disinfection: status = suggested
  ASSIGN
plastic-tunnel-disinfection: pc-number=19
plastic-tunnel-disinfection: method-perform = method (17)
thrid-leaching: status = suggested
   ASSIGN
thrid-leaching:pc-number = 21
thrid-leaching:method-perform = method (21)

germination-test: status = suggested
   ASSIGN
germination-test:pc-number = 22
germination-test:method-perform = method (22)

spraying-the-nursery-before-transplanting: status = suggested
   ASSIGN
spraying-the-nursery-before-transplanting:pc-number = 23
spraying-the-nursery-before-transplanting:method-perform = method (23)

irrigation-system-establishment: status = suggested
   ASSIGN
irrigation-system-establishment:pc-number = 24
irrigation-system-establishment:method-perform = method (24)

washing-and-testing-the-irrigation-system: status = suggested
   ASSIGN
washing-and-testing-the-irrigation-system:pc-number = 25

mulching: status = suggested
   ASSIGN
mulching:pc-number = 26
mulching:method-perform = method (26)

installing-nets: status = suggested
   ASSIGN
installing-nets:pc-number = 27
installing-nets:method-perform = method (27)

irrigation-to-field-capacity: status = suggested
   ASSIGN
irrigation-to-field-capacity:pc-number = 28
irrigation-to-field-capacity:method-perform = method (28)

transplanting: status = suggested
   ASSIGN
transplanting:pc-number = 29
transplanting:method-perform = method (29)

plant-protection-after-transplanting: status = suggested
ASSIGN
plant-protection-after-transplanting:pc-number=30
plant-protection-after-transplanting:method-perform = method (30)

plastic-tunnel-sterilization: status = suggested
(plantation:soil-steri-method-will-use1= solarization;
plantation:soil-steri-method-will-use2= solarization
ASSIGN
plastic-tunnel-sterilization:pc-number=20
plastic-tunnel-sterilization:method-perform= method (18)

plastic-tunnel-sterilization: status = suggested
(plantation:soil-steri-method-will-use1= 'methyle bromide';
plantation:soil-steri-method-will-use2= 'methyle bromide')
ASSIGN
plastic-tunnel-sterilization:pc-number=20
plastic-tunnel-sterilization:method-perform= method (19)

plastic-tunnel-sterilization: status = suggested
(plantation:soil-steri-method-will-use1= bazamide;
plantation:soil-steri-method-will-use2= bazamide)
ASSIGN
plastic-tunnel-sterilization:pc-number=20
plastic-tunnel-sterilization:method-perform= method (20)

removing-weeds: status = suggested
ASSIGN
removing-weeds:method-perform=method(31)

painting-the-plastic-tunnel-cover: status = suggested
ASSIGN
painting-the-plastic-tunnel-cover:method-perform=method (32)

waching-the-plastic-cover: status = suggested
SUGGEST
waching-the-plastic-cover:method-perform=method (33)

avoid-afternoon-spraying: status = suggested
ASSIGN
avoid-afternoon-spraying:method-perform=method(34)

avoid-high-soil-moisture: status = suggested
ASSIGN
avoid-high-soil-moisture:method-perform=method(35)

avoid-late-irrigation: status = suggested
ASSIGN
avoid-late-irrigation:method-perform=method (36)

waching-the-nets: status = suggested
  ASSIGN
waching-the-nets:method-perform=method (37)

get_ride_of_sand_or_dust: status = suggested
  ASSIGN
get_ride_of_sand_or_dust:method-perform=method (38)

nematode_op: status = suggested
  ASSIGN
nematode_op: material-qty=500
nematode_op: unit= ml/100 L.
nematode_op: method= 'soil drench'
nematode_op: tool= irrigation system
nematode_op: application-time= during day, three hours before sunset
nematode_op: material-name= vydate (liquid)
nematode_op: date = plantation:date+10
nematode_op: tool= irrigation system
nematode_op: application-time= during day, three hours before sunset

fungal_op: status = suggested
  ASSIGN
fungal_op: material-qty=100
fungal_op: unit= gm/100L
fungal_op: method= 'soil drench'
fungal_op: material-name= topsin+rhizolex_t
fungal_op: date = plantation:date+14
fungal_op: tool= irrigation system
fungal_op: disorder-name= fungal
fungal_op: application-time= during day, three hours before sunset

basins: status = suggested
soil: type={fine; medium}
  ASSIGN
basins: method-perform=method(39-a)

basins: status = suggested
soil: type= coarse
  ASSIGN
basins: method-perform=method(39b)

defer-irrigation-date: status = suggested
soil: type= coarse
ASSIGN
defer-irrigation-date: method-perform=method(40a)
defer-irrigation-date: status = suggested
soil:type=fine
    ASSIGN
defer-irrigation-date: method-perform=method(40b)
defer-irrigation-date: status = suggested
soil:type=medium
    ASSIGN
defer-irrigation-date: method-perform=method(40c)

ventilation: status = suggested
plant:current-month=1
    ASSIGN
ventilation:method-perform=method (41-a)

ventilation: status = suggested
plant:current-month=2
    ASSIGN
ventilation:method-perform=method (41-b)

ventilation: status = suggested
plant:current-month=3
    ASSIGN
ventilation: method-perform=method (41-c)

ventilation: status = suggested
plant:current-month=4
    ASSIGN
ventilation: method-perform=method (41-d)

ventilation: status = suggested
plant:current-month=5
    ASSIGN
ventilation:method-perform=method (41-e)

ventilation: status = suggested
plant:current-month=6
    ASSIGN
ventilation: method-perform=method (41-f)

ventilation: status = suggested
plant:current-month=7
    ASSIGN
ventilation: method-perform=method (41-g)

ventilation: status  = suggested
plant:current-month=8
  ASSIGN
ventilation: method-perform=method (41-h)

ventilation: status  = suggested
plant:current-month=9
  ASSIGN
ventilation: method-perform=method (41-i)

ventilation: status  = suggested
plant:current-month=10
  ASSIGN
ventilation: method-perform=method (41-j)

ventilation: status  = suggested
plant:current-month=11
  ASSIGN
ventilation: method-perform=method (41-k)

ventilation: status  = suggested
plant:current-month=12
  ASSIGN
ventilation: method-perform=method (41-l)

pruning-and-training: status = suggested
plant:season=early autumn
  ASSIGN
pruning-and-training: method-perform=method (42-a)

pruning-and-training: status = suggested
plant:season={spring; early summer; early autumn}
  :early-production=no
  ASSIGN
pruning-and-training: method-perform=method (42-b)

pruning-and-training: status = suggested
plant:early-production=no
  ASSIGN
pruning-and-training: method-perform=method (42-c)

pruning-and-training: status = suggested
plant:season={late autumn; winter}
ASSIGN
pruning-and-training: method-perform=method (42-d)

pruning-and-training: status = suggested
plant:season={spring; early summer; late summer}
plant:early-production=YES
ASSIGN
pruning-and-training: method-perform=method (42-e)

downy-mildew_op: status = suggested
ASSIGN
downy-mildew_op:advice= ventilate, reduce amount of water

fungal_op: status = suggested
ASSIGN
nematode-op:advice=check driange system

fungi_spiders_op: status = suggested
ASSIGN
fungi_spiders -op:disorder-name=fungi, spiders
fungi_spiders _op:material-name='soril super fine 89%, dithane m45'
fungi_spiders _op:quantity=table (2),equ (1),equ (2)
=(round(round(plantation:area * Mat /540)/10) * 10)
fungi_spiders _op:unit=gram
fungi_spiders -op:tool=duster
fungi_spiders -op:application-time='early m orning, before sun set, preferably afternoon'
fungi_spiders -op:advice=
Aerial dusting should carry out avoiding contact to plants. Repeating application is recommended after spraying of nutritional or chemical spraying. Modern dusters exhibit better performance, as well s two laborers are needed per one tunnel. Notice that the period between dusting and foliar spraying must be two days at least, and dusting must follow spraying. Starting from week no 8, you can increase this quantity by 50% according to the plant density in the tunnel.

Equations
Equ 1) quantity = quantity-per-gram * 2 * plantation:area
Equ 2) quantity = quantity-per-gram * plantation:area

Tables
Table 1 (rooting depth)

<table>
<thead>
<tr>
<th>Soil type</th>
<th>rd</th>
</tr>
</thead>
<tbody>
<tr>
<td>fine</td>
<td>30</td>
</tr>
<tr>
<td>medium</td>
<td>35</td>
</tr>
<tr>
<td>coarse</td>
<td>40</td>
</tr>
</tbody>
</table>

Table 2 (dithane M45 Quantity)

<table>
<thead>
<tr>
<th>Week No.</th>
<th>Season</th>
<th>quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>spring</td>
<td>750</td>
</tr>
<tr>
<td>2</td>
<td>spring</td>
<td>2000</td>
</tr>
<tr>
<td>3</td>
<td>spring</td>
<td>3000</td>
</tr>
<tr>
<td>4</td>
<td>spring</td>
<td>3000</td>
</tr>
<tr>
<td>5</td>
<td>spring</td>
<td>3000</td>
</tr>
<tr>
<td>6</td>
<td>spring</td>
<td>3000</td>
</tr>
<tr>
<td>7</td>
<td>spring</td>
<td>3000</td>
</tr>
<tr>
<td>8</td>
<td>spring</td>
<td>3000</td>
</tr>
<tr>
<td>1</td>
<td>'early summer'</td>
<td>750</td>
</tr>
<tr>
<td>2</td>
<td>'early summer'</td>
<td>2000</td>
</tr>
<tr>
<td>3</td>
<td>'early summer'</td>
<td>3000</td>
</tr>
<tr>
<td>4</td>
<td>'early summer'</td>
<td>3000</td>
</tr>
<tr>
<td>5</td>
<td>'early summer'</td>
<td>3000</td>
</tr>
<tr>
<td>6</td>
<td>'early summer'</td>
<td>3000</td>
</tr>
<tr>
<td>1</td>
<td>'late summer'</td>
<td>750</td>
</tr>
<tr>
<td>2</td>
<td>'late summer'</td>
<td>2000</td>
</tr>
<tr>
<td>3</td>
<td>'late summer'</td>
<td>3000</td>
</tr>
<tr>
<td>4</td>
<td>'late summer'</td>
<td>3000</td>
</tr>
<tr>
<td>5</td>
<td>'late summer'</td>
<td>3000</td>
</tr>
<tr>
<td>6</td>
<td>'late summer'</td>
<td>3000</td>
</tr>
<tr>
<td>1</td>
<td>'early autumn'</td>
<td>750</td>
</tr>
<tr>
<td>2</td>
<td>'early autumn'</td>
<td>2000</td>
</tr>
<tr>
<td>3</td>
<td>'early autumn'</td>
<td>3000</td>
</tr>
<tr>
<td>4</td>
<td>'early autumn'</td>
<td>3000</td>
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<tr>
<td>5</td>
<td>'early autumn'</td>
<td>3000</td>
</tr>
<tr>
<td>6</td>
<td>'early autumn'</td>
<td>3000</td>
</tr>
<tr>
<td>7</td>
<td>'early autumn'</td>
<td>3000</td>
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<tr>
<td>8</td>
<td>'early autumn'</td>
<td>3000</td>
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<tr>
<td>9</td>
<td>'early autumn'</td>
<td>3000</td>
</tr>
<tr>
<td>1</td>
<td>'late autumn'</td>
<td>750</td>
</tr>
<tr>
<td>2</td>
<td>'late autumn'</td>
<td>2000</td>
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<tr>
<td>3</td>
<td>'late autumn'</td>
<td>3000</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>---</td>
<td>-------</td>
<td>--------</td>
</tr>
<tr>
<td>4</td>
<td>'late autumn'</td>
<td>3000</td>
</tr>
<tr>
<td>5</td>
<td>'late autumn'</td>
<td>3000</td>
</tr>
<tr>
<td>6</td>
<td>'late autumn'</td>
<td>3000</td>
</tr>
<tr>
<td>7</td>
<td>'late autumn'</td>
<td>3000</td>
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<tr>
<td>8</td>
<td>'late autumn'</td>
<td>3000</td>
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<tr>
<td>9</td>
<td>'late autumn'</td>
<td>3000</td>
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<tr>
<td>10</td>
<td>'late autumn'</td>
<td>3000</td>
</tr>
<tr>
<td>11</td>
<td>'late autumn'</td>
<td>3000</td>
</tr>
<tr>
<td>12</td>
<td>'late autumn'</td>
<td>3000</td>
</tr>
<tr>
<td>13</td>
<td>'late autumn'</td>
<td>3000</td>
</tr>
<tr>
<td>14</td>
<td>'late autumn'</td>
<td>3000</td>
</tr>
<tr>
<td>1</td>
<td>winter</td>
<td>750</td>
</tr>
<tr>
<td>2</td>
<td>winter</td>
<td>2000</td>
</tr>
<tr>
<td>3</td>
<td>winter</td>
<td>3000</td>
</tr>
<tr>
<td>4</td>
<td>winter</td>
<td>3000</td>
</tr>
<tr>
<td>5</td>
<td>winter</td>
<td>3000</td>
</tr>
<tr>
<td>6</td>
<td>winter</td>
<td>3000</td>
</tr>
<tr>
<td>7</td>
<td>winter</td>
<td>3000</td>
</tr>
<tr>
<td>8</td>
<td>winter</td>
<td>3000</td>
</tr>
<tr>
<td>9</td>
<td>winter</td>
<td>3000</td>
</tr>
<tr>
<td>10</td>
<td>winter</td>
<td>3000</td>
</tr>
</tbody>
</table>
Methods
Method (1) :-
Disinfection of Plants and Plastic
At the end of the season and before getting rid of the crop, it is advisable to determine insects, bacteria, and fungus that may affect the new plantation by spraying the tunnel from inside by selecron 0.3% conc. (50 L./tunnel) and close the tunnel for 2-3 days.

Method (2) :-
Getting Rid of Previous Crop
After 2-3 days from tunnel disinfection:
- Pull out the plants.
- Collect plant residues.
- Transfer the residues outside in heap far from the site to be burned or composted.

Method (3) :-
Collect Irrigation Lines
Before soil preparation, collect irrigation lines and hang them on both sides of the tunnel. Avoid bending to protect them from damage (cutting and tearing).

Method (4) :-
Install Drainage System
It is an important operation to be done if the soil texture is heavy and plants suffer from water logging. It is carried out by installing drainage perforated plastic pipes (2 lines/tunnel) it must be buried at depth of 50 cm. from soil surface and connected to the submain and main system.
Method (5):-

Adding Gypsum

This operation is done in the Alkline clay soil, before plantation, or during soil preparation. Spread the gypsum requirements in amount equal or less than 1kg/1 square meter. Plow the soil at 30 Cm depth, adding at least 10 cm water above soil level. Repeat the above step if the Gypsum requirements is higher than 1 Kg/ one square meter.

Method (6):-

Cultivate Maize

To reduce nematode population. At the same time it is used as green fodder.

Method (7):-

Plowing

It must be done carefully at depth of 20-30 cm two times for soil airation and killing the soil borne diseases.

Method (8):-

First Leaching

It aims to leach salts down the rizosphere and reduce soil salinity, water required depend on soil texture.

Method (9):-

Ditching

Making a narrow, shallow trench in the soil at a depth of 10-15 CM to add the manure and basic fertilizers in.

Method (10):-

Adding Organic Manure

Refer to fertilization Schedule
Method (11):-
Adding Chemical Fertilizers
Refer to fertilization Schedule

Method (12):-
Adding Sulphur
To overcome the Alkalinity, where PH > 7.5. Adding 4 - 5 K Sulphur through preparation.

Method (14):-
Rotary Plowing
This operation is done to mix the manure and base deressing with the soil and gives a homogenous mixture, at the same time allows the soil blocks to be broken into small and having a smooth texture

Method (15):-
Ridging
if tunnel width = 8.5 M:
1- leave 75 cm from each sides.
2- Make 5 ridges (mastaba) 30 cm heigh 100 cm width for each, the distance between two ridges (Mastaba) = 50 CM
if tunnel width = 9 M:
1. leave 80 cm from each side
2. make 5 ridges (Mastaba) 30 cm heigh and width 100 cm for each, the distance between two ridges = 60 CM
Notes:- the distance 75 cm or 80 cm between the tunnel side and the first ridge must be left to allow the labors to do the training and agricultural practices. The ridger is used to ridge with the above dimensions. Ridges can be done using mechanical ridger or manually using strings to fix the above dimensions. Surface should be flat, smooth and free of hard objects.
When the distance of the soil strip is 9m:

The distance is 80 cm from the edge of the soil strip

An area of 50 m² and a distance of 100 cm from the area in which the soil strip is located

Features:

The distances in the soil strip and adjacent to the distance of the strip are used. No crop is grown before and after the distance of the strip. The crop is grown before the distance of the strip and after the distance of the strip.

Method (16):-

Second Leaching

To get rid of the salts of manure. The quantity of water (Ltr/area) is:

Method (17):-

Plastic Tunnel Disinfection

At the beginning of the plant season. Protect the plant from different diseases. To exterminate insects, bacteria and fungi that will infect the plants if they exist. Prepare 50 ltr. of selecrotene for each tunnel, concentrated 0.005. Spray the inside tunnel with the prepared solution using a spraying motor.

Method (18):-

Plastic Tunnel Sterilization

Solirization Method

1- heavy irrigation, wait till the soil moisture reach 65-70% (test for this rate, by pressing a mass of soil by hand if it takes the shape of hand without extracting water from the soil, it means that the soil has the right humidity.

2- Covering all soil area with plastic sheets, the plastic sheets must be tied well in the edges.

3- Take off the plastic sheets after 4-6 weeks, then leave the soil for 1-2 week for airing.

The remeasure

The remeasure process

1- If a heavy rain, wait for the moisture of the soil strip for 24 hours. If no crop is grown before the soil strip, the crop is grown before the distance of the strip.

2- Tidy the leaves of the plants

3- It is 10 days from the beginning of the rainy season to the end of the rainy season, and through the whole season.
Method (19): -

**Plastic Tunnel Sterilization**

**Mythyle Bromide Method**

1- heavy irrigation, wait til the soil moisture reach 65-70% (test for this rate, by pressing a mass of soil by hand if it takes the shape of hand without extracting water from soil it means that the soil has the right humidity.

2- extend the plastic polared tubes, tie it from the tow ends, the interval between them is 1-2 meters, then cover with the plastic sheats tightly.

3- let the gas passes through tubes at rate of 50-60 gms. of Methyle Bromide/ square meter calculated by parometer.

4- take off the plastic sheets after 4 days, leave the soil other 3 days for aeration

5- high irrigation must be done for getting rid of the gas inside the soil.

6- ridge after 10 days.

Method (20): -

**Plastic Tunnel Sterilization**

**Bazamide Method**

Soil moisture must be at 50-60% of its water field capacity for 7-14 days prior to application and 4-12 days after application. Soil temperatures of 10-20 C after the best conditions for this treatment. Rates to use at various depth. It is recommended to use 4 kg/100 m2. It could be raised to 5 kg/100m2 in cases of high soil infection with soil born diseases, weeds and heavy soils.

Application and incorporation basamid should be spread evenly over the soil surface. Immediately after spreading the granules should be worked into the required depth (20-30 cm) as completely as possible. It can be done by a fast rotating rotary cultivator. Sealing the soil surface. Seal the soil surface by adding water(igation) at a rate of 10-15 L water/m2 Repeat before soil surface dries out avoid dryness for 4-12 days. In light soils it is better to cover the soil with P.E. sheeting after watering and rolling and it must be in continuous contact with the soil surface by applying water on top. Lossing the soil and areation. The soil should be lossened and thoroughly areated after 4-12 days never further down the original incorporation depth, wait 2-20 days and repeat soil areation, wait 3-7 days and repeat areation till no traces of gas can be detected by germination test.

Soil Areation Germination Time allowed between
temperature days after test days after treatment allowing at 10 cm d. treatment treatment two days for germination test

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Test Days</th>
<th>Treatment Days</th>
<th>Approximate Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>25°C</td>
<td>4</td>
<td>6</td>
<td>approx. 8 days</td>
</tr>
<tr>
<td>20°C</td>
<td>6</td>
<td>9</td>
<td>approx. 11 days</td>
</tr>
<tr>
<td>15°C</td>
<td>8</td>
<td>13</td>
<td>approx. 15 days</td>
</tr>
<tr>
<td>10°C</td>
<td>12</td>
<td>22</td>
<td>approx. 24 days</td>
</tr>
<tr>
<td>5°C</td>
<td>25</td>
<td>45</td>
<td>approx. 47 days</td>
</tr>
</tbody>
</table>

**Method (21):**

Leaching

To leach down the gaseous residues of materials used in soil sterilization. The quantity of water (Ltr/area) is:

**Method (22):**

Germination Test

Before treated soil is used, it is must to do a safety test using Cress. Lettuce or Radish seeds. Samples of treated soil are taken from various places and from various depths, fill a jar with a screw with the samples. A moist cotton pad is dipped in cress seed and hung by a string close to the soil in the jar. Close the jar immediately and tightly with a rubber band, place in sunny warm place. Use a second as a control (filled with untreated soil) Gress seeds germinate in 1-2 day at 20 C during this period the presence of residues is revealed by the absence or delay of germination or discoloration of the cress. In such cases repeat aeration and repeat the germination test till make sure that there is no traces of gas in the soil.

**Examination of the plants:**

The purpose of examining the plants is to determine whether the treated soil is safe for planting. In order to do this, samples of treated soil are taken from various places and from various depths, fill a jar with a screw with the samples. A moist cotton pad is dipped in cress seed and hung by a string close to the soil in the jar. Close the jar immediately and tightly with a rubber band, place in sunny warm place. Use a second as a control (filled with untreated soil) Gress seeds germinate in 1-2 day at 20 C during this period the presence of residues is revealed by the absence or delay of germination or discoloration of the cress. In such cases repeat aeration and repeat the germination test till make sure that there is no traces of gas in the soil.

**Examination of the soil:**

The purpose of examining the soil is to determine the effectiveness of the sterilization process. In order to do this, samples of treated soil are taken from various places and from various depths, fill a jar with a screw with the samples. A moist cotton pad is dipped in cress seed and hung by a string close to the soil in the jar. Close the jar immediately and tightly with a rubber band, place in sunny warm place. Use a second as a control (filled with untreated soil) Gress seeds germinate in 1-2 day at 20 C during this period the presence of residues is revealed by the absence or delay of germination or discoloration of the cress. In such cases repeat aeration and repeat the germination test till make sure that there is no traces of gas in the soil.

**Examination of the plants:**

The purpose of examining the plants is to determine whether the treated soil is safe for planting. In order to do this, samples of treated soil are taken from various places and from various depths, fill a jar with a screw with the samples. A moist cotton pad is dipped in cress seed and hung by a string close to the soil in the jar. Close the jar immediately and tightly with a rubber band, place in sunny warm place. Use a second as a control (filled with untreated soil) Gress seeds germinate in 1-2 day at 20 C during this period the presence of residues is revealed by the absence or delay of germination or discoloration of the cress. In such cases repeat aeration and repeat the germination test till make sure that there is no traces of gas in the soil.
Method (23): -

Spraying the Nursery before Transplanting
Before transplanting two days, spray the nursery by vydade 0.005 ml/gram

Method (24): -

Irrigation System Establishment
After setting ridges, sublaterals and laterals layout. The laterals lay on the front of the tunnel while the sublaterals lay on the ridge 20 cm apart from the edges. For vegetables it is recommended to use drippers having discharge of 4 L./h

Method (25): -

Washing and Testing the Irrigation System
Washing of the irrigation system is done to solve the nutrients and impurities those dried out and may clogging the drippers by using Nitric acid 8-10 Kg/200/250Ltr/Water. This operation should be done every 2 weeks. After washing the system a test carried out to the whole system to make sure that it is going well without any leakage, and all the water pressures are good through out the system

Method (26): -

Mulching
The aim of this operation is to protect the roots from heat, cold, drought, increasing the Co2 arround plants decrease irrigation and fertilizers requirements, earliness increasing yield, and good quality fruits. It is done by spreading P.E sheat over the ridge and bury it at both sides and edges tightly, The sheat thickness arround 40-50 micron, Its color differs according to the purpose of its use Transparent P.E. is used during fall plantation if the soil is sterilized, while black P.E is recommended if the soil is not sterilized.
Installing Nets

At the beginning of planting season, protection against insects (White fly, Thrips, Aphids and Mites) in this respect nets (500 holes/in sh) are used to cover doors, half moon and vents opening. This operation minimize the chance of viral infection.

Irrigation to Field Capacity

This operation should be done just before transplanting through drip irrigation and before making the holes. It differs from type to type of soils. Avoiding excess watering

Transplanting

Transplanting should be done early morning or afternoon by placing the seedling in the hole and bury it and make the media surface at the same level of the soil and 5cm apart from dripper. Irrigation is required after transplanting

Plant Protection after Transplanting

To avoid the infection of young plants by soil fungal diseases, it is generally advisable to add a tea spoon full of a mixture composed of dry clean sand (after washing by fresh water for several times) : Copper Oxychloride : agricultural sulphur : (topsin or benlate) 10 : 1 : 1 : 0.1 weight/weight respectively. This amount could be enough for more than one tunnel

Just after transplanting, the mixture is applied by surrounding the margin of the top of moss peat block of each seedling; provided that the top of the block should be at the same level of soil surface, after fixing the block at sides
Method (31):-

**Removing Weeds**

In none sterilized tunnels pulling weeds from inside is necessary to avoid spreading out insects and diseases as they are good hosts for them. It is done by hand periodically. Also you never let weeds grow in between tunnels and around the side.

Method (32):-

**Painting the Plastic Tunnel Cover**

It is done to avoid excess of heat inside the tunnel in early April by using Spedage 8-10 Kg /250 L. Water - 30 Kg/tunnel.

Method (33):-

**Waching the Plastic Cover**

It is done by using water and liquid soap to get rid of dirt accumulated over it in order to increase light transmissivity and temperature.

Method (34):-

**Avoid afternoon Spraying**

It is important not to do any spraying at after-noon in order to avoid spreading out air-born diseases due to high humidity inside the tunnel through out the night specially in fall and winter season.

Method (35):-

**Avoid High Soil Moisture**

Do the irrigation schedule according to the program, avoiding high soil moisture particularly in heavy soils because it lead to activate soil born diseases, damaging the...
Method (36):

**Avoid Late Irrigation**

Late irrigation in heavy soils not recommended because the soil permeability is low and it could increase humidity inside tunnel during night that enhances spreading out airborne diseases

**Method (37):**

**Washing the Nets (Saran)**

It keeps the nets always clean by washing to provide good ventilation. To increase the efficiency of this procedure by using high pressure motors sprayers to wash the nets from inside to outside to avoid increasing soil humidity inside the tunnel.

**Method (38):**

**Get rid of sand or dust**

Spray thoroughly Cupper Oxychlor 0.3% after wind blow

**Method (39a):**

**Basins**

The greenhouse area in heavy soils divided into 12 basins. (4.25 X 10 m.)

**Method (39b):**

**Basins**

- In light soils the number of basins could be 16 basins. (4.25 X 7.5 m)

**Method (40a):**

**Defer irrigation date**
- Sterilization method in light soil needs 21 days from the first step till transplanting. So you have to shift the plantation date.

Mthod (40b) :-

- Sterilization method in heavy soil needs 45 days from the first step till transplanting. So you have to shift the plantation date.

Method (40c) :-

- Sterilization method in medium soil needs 45 days from the first step till transplanting. So you have to shift the plantation date.

Method (41a):-

Ventilation

Ventilation is done to control humidity and temperature inside the tunnel through the south and north doors, side openings and/or upper openings. Normally openings area allow complete change of air volume. Opening area is 25-30% of the total area of the plastic house but the number of required openings and time needed for good ventilation is depending on:

- Temperature
- Clouds
- Winds

Ventilation starts in the morning two hours after sunrise until 3-4 oclock P.M.
- In case of clear weather without any strong winds. Two hours after sunrise open the south door, followed by the north door and the side opening. At 3:0 P.M. close them.
- In case of cloudy weather without any strong winds Open the south and north doors to control the humidity inside the tunnel then close the doors or let them opened according to the temperature and weather conditions during the daytime. If the day temperature is ranging between 18-25 C. Let the doors opened until 3 PM, but if it is below 18 C close the doors after decreasing the inside relative humidity to 70-75%
- In case of windy weather, Leaf the door close and do ventilation through the side openings and upper.
- In case of storm weather. During the stormy weather close the doors immendiately to avoid tunnel and plant damage. It is recommended to leaf the upper opening partially opened during the night.
- Close the top openings during rainfall and fog.
Method (41b) :-

Ventilation

Ventilation is done to control humidity and temperature inside the tunnel through the south and north doors, side openings and/or upper openings. Normally openings area allow complete change of air volume Opening area is 25-30% of the total area of the plastic house, but the number of required openings and time needed for good ventilation is depending on:-

- Temperature
- Clouds
- Winds

Ventilation starts in the morning two hours after sunrise until 3-4 o'clock P.M.

- In case of clear weather without any strong winds. Two hours after sunrise open the south door, followed by the north door and the side opening. At 3:0 P.M. close them.
- In case of cloudy weather without any strong winds Open the south and north doors to control the humidity inside the tunnel then close the doors or let them opened according to the temperature and weather conditions during the daytime. If the day temperature is ranging between 18-25 C. Let the doors opened until 3 PM, but if it is below 18 C close the doors after decreasing the inside relative humidity to 70-75%.
- In case of windy weather. Leaf the door close and do ventilation through the side openings and upper.
- In case of storm weather. During the stormy weather close the doors immediately to avoid tunnel and plant damage. It is recommended to leaf the upper opening partially opened during the night.
- Close the top openings during rainfall and fog.

التهوية
Method (41c) :-

Ventilation

Ventilation is done to control humidity and temperature inside the tunnel through the south and north doors, side openings and/or upper openings. Normally openings area allow complete change of air volume. Opening area is 25-30% of the total area of the plastic house but the number of required openings and time needed for good ventilation is depending on:-
- Temperature
- Clouds
- Winds

Ventilation starts in the morning two hours after sunrise until 3-4 oclock P.M. If the day temperature is between 18 and 28 C let all the doors and side opening opened along the day and close them except the upper ones at night when temperature is belows 18 C - In case of storm weather During the stormy weather close the doors immediatly to avoide tunnel and plant damage.
Method (41d) :

**Ventilation**

Ventilation is done to control humidity and temperature inside the tunnel through the south and north doors, side openings and/or upper openings. Normally openings area allow complete change of air volume Opening area is 25-30% of the total area of the plastic house but the number of required openings and time needed for good ventilation is depending on:-

- Temperature
- Clouds
- Winds

Ventilation starts in the morning two hours after sunrise until 3-4 o'clock P.M.

If the day temperature is between 18 and 28°C let all the doors and side or upper opening opened all day and close them at night when temperature is belows 18°C

- In case of storm weather. During the stormy weather close the doors immediatly to avoid tunnel and plant damage.

Method (41e) :

**Ventilation**

Ventilation is done to control humidity and temperature inside the tunnel through the south and north doors, side openings and/or upper openings. Normally openings area allow complete change of air volume Opening area is 25-30% of the total area of the plastic house but the number of required openings and time needed for good ventilation is depending on:-

- Temperature
- Clouds
- Winds

Ventilation starts in the morning two hours after sunrise until 3-4 o'clock P.M.

Let the doors and all the openings opened day and night
Method (41f) :-

Ventilation

Ventilation is done to control humidity and temperature inside the tunnel through the south and north doors, side openings and/or upper openings. Normally openings area allow complete change of air volume Opening area is 25-30% of the total area of the plastic house but the number of required openings and time needed for good ventilation is depending on:-

- Temperature
- Clouds
- Winds

Ventilation starts in the morning two hours after sunrise untill 3-4 oclock P.M. June, Let the doors and all the openings opened day and night

Method (41g) :-

Ventilation

Ventilation is done to control humidity and temperature inside the tunnel through the south and north doors, side openings and/or upper openings. Normally openings area allow complete change of air volume Opening area is 25-30% of the total area of the plastic house but the number of required openings and time needed for good ventilation is depending on:-

- Temperature
- Clouds
- Winds
Ventilation starts in the morning two hours after sunrise until 3-4 o'clock P.M. **July**, let the doors and all the openings opened day and night.

**Method (41h):**

Ventilation

Ventilation is done to control humidity and temperature inside the tunnel through the south and north doors, side openings and/or upper openings. Normally openings area allow complete change of air volume Opening area is 25-30% of the total area of the plastic house, but the number of required openings and time needed for good ventilation is depending on:

- Temperature
- Clouds
- Winds

Ventilation starts in the morning two hours after sunrise until 3-4 o'clock P.M. Let the doors and all the openings opened day and night.

**Method (41i):**

Ventilation

Ventilation is done to control humidity and temperature inside the tunnel through the south and north doors, side openings and/or upper openings. Normally openings area

TR/CLAES/251/2002.10
allow complete change of air volume Opening area is 25-30% of the total area of the plastic house
but the number of required openings and time needed for good ventilation is depending on:-

- Temperature
- Clouds
- Winds

Ventilation starts in the morning two hours after sunrise until 3-4 o'clock P.M.
Let the doors and all the openings opened day and night

Method (41j) :-

Ventilation
Ventilation is done to control humidity and temperature inside the tunnel through the south and north doors, side openings and/or upper openings. Normally openings area allow complete change of air volume Opening area is 25-30% of the total area of the plastic house
but the number of required openings and time needed for good ventilation is depending on:-

- Temperature
- Clouds
- Winds

Ventilation starts in the morning two hours after sunrise until 3-4 o'clock P.M.
If the day temperature is between 18 and 28 C let all the doors and side opening opened allong the day and close them except the upper ones at night when temperature is belows 18 C
Method (41k) :-

Ventilation

Ventilation is done to control humidity and temperature inside the tunnel through the south and north doors, side openings and/or upper openings. Normally openings area allow complete change of air volume Opening area is 25-30% of the total area of the plastic house but the number of required openings and time needed for good ventilation is depending on:-

- Temperature
- Clouds
- Winds

Ventilation starts in the morning two hours after sunrise untill 3-4 oclock P.M.

If the day temperature is between 18 and 28 C let all the doors and side or upper opening openended allong the day and close them at night when temperature is belows 18 C It is recommended to leaf the upper opening partially opened during the night.

- In case of storm weather. During the stormy weather close the doors immendiately to avoide tunnel and plant damage.

Method (41l) :-

Ventilation

Ventilation is done to control humidity and temperature inside the tunnel through the south and north doors, side openings and/or upper openings. Normally openings area allow complete change of air volume Opening area is 25-30% of the total area of the plastic house
but the number of required openings and time needed for good ventilation is depending on:-
- Temperature
- Clouds
- Winds

Ventilation starts in the morning two hours after sunrise until 3-4 o'clock P.M.
If the day temperature is between 18 and 28 C let all the doors and side or upper opening opened all day and close them at night when temperature is below 18 C. It is recommended to leave the upper opening partially opened during the night.
- In case of storm weather. During the stormy weather close the doors immediately to avoid tunnel and plant damage.
- Close the top openings during rainfall and fog.

Method (42a):

**Pruning and Training**

1- Remove all the laterals up till 50 cm height from soil surface.
2- Remove all the flowers up till the fourth node.
3- Punch the laterals after the second leaf.
4- Then, leave all the flowers on the main stem and punch the tips of lateral branches after the second leaf. Continue this process until the plant reach the crop support.
5- Twist the two internodes of main stem around the crop support, then leave the main stem growing downwards for 1.5 m., then punch plant tips.

**Notes:**
1- Number of nodes should be respected during training.
2- Remove all the infected or dried leaves at any stage of growth.
3- Remove all the malformed fruits.
4- Punching must be done in early morning.
5- In case of weak growth and thin main stem, continue removing flowers and laterals branches till 80 cm. if plant growth is weak leave one leaf from the laterals and punch after that.
6- Collect all the cutting parts out of plastic tunnel to be burned or burried.
7- In case of losing plant tips or damaging main stem at any point, leaves the nearest
latteral to the plant top and treat it as a main steam.
8- Donot remove more than four leaves per plant weekly to avoid stress from the lower
parts of the plants (that contact the soil surface)
9- These operations should be done carefully to avoid fungal insects and spider mites
infection. At the same time you will have a good quality of fruits and enhance plant
growth up words and decrease the number of dried fruates and permit good ventilation.

Method (42b):-
Pruning and Training
1- Remove all the latterals up till 50 cm height from soil surface.
2- Remove all the flowers up till the fourth node.
3- Punch the laterals after the second leaf.
4- Then, leave all the flowers on the main stem and punch the tips of lateral branches
after the second leaf. Continue this process until the plant reach the crop support.
5- Twist the two internodes of main stem around the crop support, then leave the main
stem growing downwards for 1.5m., then punch plant tips.
Notes:-
1- Number of nodes should be respected during training.
2- Remove all the infected or dried leaves at any stage of growth.
3- Remove all the malformed fruits.
4- Punching must be done in early morning.
5- In case of weak growth and thin main stem, continue removing flowers and laterals branches til 80cm. if plant growth is weak leave one leaf from the laterals and punch after that.
6- Collect all the cutting parts out of plastic tunnel to be burned or burried.
7- In case of losing plant tips or damaging main stem at any point, leaves the nearst lateral to the plant top and treat it as a main steam.
8- Donot remove more than four leaves per plant weekly to avoid stress from the lower parts of the plants (that contact the soil surface
9- These operations should be done carefualy to avoid fungal insects and spider mites infection. At the same time you will have a good quality of fruits and enhance plant growth up words and decrease the number of dried fruites and permit good venttilation.

Method (42c) :-

Pruning and Training
1- Remove all the latterals up till 50 cm height from soil surface.
2- Remove all the flowers up till the fourth node.
3- Punch the laterals after the third leaf up til the wire of the crop support.
4- Twise the two internodes of main stem around the crop support then leave the main stem growing downwords for 1.5 m., then punch plant tip. also punch the lateral branches.
5- In case of the presents of sublateral prune it after the first leaf only.
6- It is necessary to make a vegetative growth balance for the plants during the growing season and this operation could be done by removing some of the leaves to provide good aeration and decrease fungal infection.

Notes:-
1- Number of nodes should be respected during training.
2- Remove all the infected or dried leaves at any stage of growth.
3- Remove all the malformed fruits.
4- Punching must be done in early morning.
5- In case of weak growth and thin main stem, continue removing flowers and laterals branches til 80cm. if plant growth is weak leave one leaf from the laterals and punch after that.
6- Collect all the cutting parts out of plastic tunnel to be burned or buried.
7- In case of lossing plant tips or damaging main stem at any point, leaves the nearest branches til 80cm. if plant growth is weak leave one leaf from the laterals and punch after that.
8- Donot remove more than four leaves per plant weekly to avoid stress from the lower parts of the plants (that contact the soil surface
9- These operations should be done carefully to avoid fungal, insects and spider mites infection. At the same time you will have a good quality of fruits and enhance plant growth up words and decrease the number of dried fruites and permit good ventilation.

مناقشة التكاثر والتربيبة
1- إزالة كل الأفروض الثانوية من على الساق الرئيسية حتى ارتفاع 50 سم
2- إزالة كل الأزهار حتى العقدة الرابعة
3- قطف الأفروض الثانوية بعد الورقة الثانوية
4- بعد وصول النباتات إلى حامل المحصول تلف قم النباتات على السلك الرئيسية لتنمو إلى اسفل مسافة 1.5 متر من مستوى سلك حامل المحصول بعد ذلك تتصفق قم النباتات وكذلك الأفروض الثانوية.
5- في حالة ظهور الأفروض الثانوية تقدم بعد الورقة الأولى بعد الورقة الأولى فقط.
6- من الضروري عمل توازن في مرحلة النمو الخاضر بالنسبة للنباتات خلال فترة النمو، وهذه العملية تستطيع عملها بإزالة بعض الأوراق لكي تمدنا على تهويه جيده

الخاتمة:
1- مراحة عند العقد عند التربية
2- تزال الأوراق المصابة والجافة في الجزء السفلي من النباتات خلال مراحل النمو ولايجب عد الأوراق المزالة أسبوعياً عن أربع وروقات
3- إزالة جميع التأمل المشوهة
4- يجب مراحة تنقية عملية التربية والتربيبة في الصباح الباكر
5- في حالة النباتات الضعيفة والمرسولة تزال الثمار والازهار حتى ارتفاع 80 سم عن سطح التربة في حالة ضعف النمو بالنسبة للنباتات يتم تصفيف الأفروض الثانوية بعد الورقة الأولى مباشرة.
6- تجميع نواتج عمليات السرطة (المخلفات النباتية) واستبعادها من السوطون ليتم حرقها ودفنهما.
7- في حالة فقد الفهاء الناتج للأوراق أو عنق في الساق الرئيسية عند أي نقطة. يتم قلب أقرب فرع ثانوي للنبات لقمة النبات ومعالجته من الساق الرئيسية.
8- يجب الإزالة أكثر من أربع وروقات بالنسبة للنباتات خلال الأسبوع لتجنب الإجهاد على الجذور السفلني للنباتات
9- يجب مراحة تنقية هذه التوصيات السابقة بكل دقة لتتاغير الأزهار الفطرية والحشرية و الأکاسيوسية كما تؤدي إلى زيادة التهويه عند الجزء السفلي من النباتات، هذا علاوة على الحصول على ثمار ذات مواصفات جيدة وتشبع النباتات على النمو الى أعلى و تقليص نسبة الثمار المعرضة للجفاف (تنفيف)
Method (42d) :-

Pruning and Training
1- Remove all the flowers and laterals up to 50-60 cm. height.
2- Then, leave all the flowers on the main stem and punch the tips of lateral branches after the second leaf. Continue this process until the plant reach the crop support.
3- Twist the two internodes of main stem around the crop support, then leave the main stem growing downwards for 1.5m., then punch plant tips also punch the lateral branches after the second leaf as mentioned in 2
4- Leave the two lateral branches growing from axillary buds of the two leave close to the wire of the crop support to grow together with the main stem and train them as the main stem. The final shape is like umbrella.

Notes:-
1- Number of nodes should be respected during training.
2- Remove all the infected or dried leaves at any stage of growth.
3- Remove all the malformed fruits.
4- Punching must be done in early morning.
5- In case of weak growth and thin main stem, continue removing flowers and laterals branches til 80cm. if plant growth is weak leave one leaf from the laterals and punch after that.
6- Collect all the cutting parts out of plastic tunnel to be burned or burried.
7- In case of lossing plant tips or damaging main stem at any point, leaves the nearest lateral to the plant top and treat it as a main stem.
8- Donot remove more than four leaves per plant weekly to avoid stress from the lower parts of the plants (that contact the soil surface.
9- These operations should be done carefualy to avoid fungal, insects and spider mites infection. At the same time you will have a good quality of fruits and enhance plant growth up words and decrease the number of dried frutes and permit good venttilation.

ملاحظات :-
1) مراجعة عند العقد عند التربية
2) تزال الأوراق المصابة والجافة في الجزء السفلي من النباتات خلال مراحل النمو ولايتعد عدد الأوراق المزالة
3) ازالة جميع النبات المشوهة
4) يجب مراجعة تنفيذ عملية التربية والتغذية في الصباح الباكر
Method (42e) :-

Pruning and Training
1- Remove all the flowers and laterals up to 50-60 cm. height.
2- Then, leave all the flowers on the main stem and punch the tips of lateral branches after the second leaf. Continue this process until the plant reach the crop support.
3- Twist the two internodes of main stem around the crop support then leave the main stem growing downwards for 1.5m., then punch plant tips also punch the lateral branches after the second leaf as mentioned in 2

Notes:-
1- Number of nodes should be respected during training.
2- Remove all the infected or dried leaves at any stage of growth.
3- Remove all the malformed fruits.
4- Punching must be done in early morning.
5- In case of weak growth and thin main stem, continue removing flowers and laterals branches til 80cm. if plant growth is weak leave one leaf from the laterals and punch after that.
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7- In case of losing plant tips or damaging main stem at any point, leaves the nearest lateral to the plant top and treat it as a main steam.
8- Donot remove more than four leaves per plant weekly to avoid stress from the lower parts of the plants (that contact the soil surface
9- These operations should be done carefully to avoid fungal, insects and spider mites infection. At the same time you will have a good quality of fruits and enhance plant growth up words and decrease the number of dried fruiites and permit good ventilation.
10- The early picking could be malformed and due to its contact with the soil it could be spoiled and infected with fungal diseases
بعد وصول النباتات إلى حامل المحصول تلف قمم النباتات على السلك الرئيسي لتنمو إلى اسفل مسافة 0.5 متر من مستوى سلك حامل المحصول. بعد ذلك تقصف قمم النباتات للكشف الأفرع الثانوية. ويعامل هذا الجزء معاملة الساق الرئيسي.

ملاحظات:
1) مراعاة عند العدد عند التربيع.
2) تزال الأوراق المصاببة والجافة في الجزء السفلي من النباتات خلال مراحل النمو ولا ينعد عدد الأوراق المزالة أسبوعياً عن أربع ورقائات.
3) إزالة جميع الثمار المشوهة.
4) يجب مراعاة تنفيذ عملية التربيع وتقليل الصباح الباكر.
5) في حالة النباتات الضعيفة والمرسولة تزال الثمار والأزهار حتى ارتفاع 80 سم عن سطح التربة في حالة ضعف النمو بالنسبة للنباتات يتم تقصيف الفرع الثانوي بعد الورقه الأولى مباشرة.
6) تجميع نواتج عمليات السرطة (المخلفات النباتية) واستبعادها من الصوبية ليتم حرقها ودفنهما.
7) في حالة فقد القمة النامية للنبات أو تلف في الساق الرئيسي عند أي نطفة. يترك أقرب فرع ثانوي للنبات لقمه النبات ومعاملتها مثل الساق الرئيسي.
8) يجب الإيلاء أكثر من أربع ورقائات بالنسبة للنبات خلال الأسبوع لتجنب الإجهاد على الجزء السفلي للنبات القريب من سطح التربة.
9) يجب مراعاة تنفيذ هذه التوصيات السابقة بكل دقة لتخفيف الإصابات القطرية والحشرية والأكاروسية كما توفر إلى زيادة التهوية عند الجزء السفلي من النبات، هذا علاوة على المحصول على ثمار ذات مواصفات جيدة وتشجيع النباتات على النمو إلى أعلى وتقليل نسب الإصابات المعرضة للجفاف (تغليف).
10) الثمار الناتجة من المحصول المبكر قد يوجد بها بعض التشوهات علاوه على ملامستها للتربيع والصابيا.

بالإضافة
3. Inference Knowledge

2.3 Inference Structure

Inference structure is shown in figure 1.

Figure (1): inference structure
2.4 Inference specification

inference: Determine
  operation-type: calculate before and after plantation period.
  input-roles: Curent Date, Plantation date.
  output-roles: plantation statues.
  static-roles: Determine ∈ determine –model.
  spec: the current plantation status by applying "Determine" relation.

inference: suggest
  operation-type: suggest the agricultural operations.
  input-roles: Environment, Plantation statues.
  output-roles: Suggested operations.
  static-roles: Suggest ∈ suggestion–model.
  spec: the suggested operation are to be suggested by applying "Suggest" relation.

inference: assign
  operation-type: assign parameters to the suggested operation.
  input-roles: Suggested operations.
  output-roles: Operation details.
  static-roles: Assign ∈ assignment–model.
  spec: assign the method to the suggested operation by applying "Assign" relation.
4. Task Knowledge

task: cuptex plant care;

task-definition:
  goal: suggest the agricultural operations;

  output: Operation details { suggested operation, importance, material, method, text, video}

task-body:
  type: composite
  subtasks: determine, suggest, assign
  additional-roles:
  control-structure:

OBTAIN (properties for plantation(P), appearance(A), climate(C), plant(PL), Last-infection(L),climate(C))
  % from user by using screen in figure 2
OBTAIN (plantation:date, drainage-system(PD) & soil:type, soil_steri_will_use (SD)&climate: avg_tc(WS) )% from database,

determine(P → PS)
suggest(PS,P, A, C,PL, L,C → OP:selected operations),
assign(Operations, OP → OPD: Operations details),
PRESENT(OP, OPD)
5. User Interface

5.1 Input
The data input screen is shown in figure 2.

<table>
<thead>
<tr>
<th>النظام الخبير للخيارات</th>
</tr>
</thead>
<tbody>
<tr>
<td>هل تريد محصول مبكر</td>
</tr>
<tr>
<td>ظرف البلاستك</td>
</tr>
<tr>
<td>هل تعرضت الصويبة للإصابة بالنيماتود خلال العروة السابقة</td>
</tr>
<tr>
<td>ظرف الانتهاء</td>
</tr>
<tr>
<td>هل قمت بتحليل التربة بالنسبة للنلماتود</td>
</tr>
<tr>
<td>ما هي نتيجة تحليل التربة بالنسبة للنلماتود</td>
</tr>
<tr>
<td>ما هو نوع النلماتود الموجود في التربة</td>
</tr>
<tr>
<td>هل قمت بتحليل التربة بالنسبة للفطر</td>
</tr>
<tr>
<td>ما هي نتيجة تحليل التربة بالنسبة للفطر</td>
</tr>
<tr>
<td>هل تعرضت الصويبة للإصابة بالفطر خلال العروة السابقة</td>
</tr>
</tbody>
</table>

figure 2: Input screen

5.2 Output
The suggested operation is displayed in the screen shown in figure 3. When clicking on operation name, its detail is shown in the detail area.

<table>
<thead>
<tr>
<th>النظام الخبير لرعاية النبات</th>
</tr>
</thead>
<tbody>
<tr>
<td>الظرفيات:</td>
</tr>
<tr>
<td>عملية 1</td>
</tr>
<tr>
<td>عملية 2</td>
</tr>
<tr>
<td>تفاصيل العملية 1</td>
</tr>
<tr>
<td>detail area</td>
</tr>
</tbody>
</table>

figure 3: Output screen
6. Test Cases

Case 1
Input
Current date = 1/10/2002
plantation:date = 25/9/2002
plantation: soil_sterilization = not exist
last_infection:soil-sterilization='not exist'
last_infection:nematode-exist=yes
plant:season = early autumn
appearance :weed_exist=yes
plantation: mulch-used = no
soil:type = fine
climate:wind = no
Output
nematode_op
downy-mildew_op
Fungi_spiders_op
removing-weeds
waching-the-plastic-cover

Case 2
Input
Current date = 1/10/2002
plantation:date = 25/9/2002
plantation: soil_sterilization = not exist
last_infection:soil-sterilization='not exist'
last_infection:nematode-exist=yes
plant:season = early autumn
appearance :weed_exist=no
soil:type = fine
climate:wind = yes
plantation: mulch-used = no
Output
nematode_op
downy-mildew_op
Fungi_spiders_op
waching-the-plastic-cover
get_ride_of_sand_or_dust
Mulching
Case 3

Input
Current date = 1/12/2002
plantation:date = 25/12/2002
soil:ec=1.5
soil:ph=5
plant:rd
plantation:area
plantation: soil sterilization = not exist
last_infection:nematode-exist=yes
last_infection:analysis-nematode=yes
last_infection:analysis-nematode-status=low
last_infection:fungle-exist=no
plant:season = winter
appearance :weed_exist=no
plantation: mulch-used = no
soil:type = fine
climate:wind = no
plantation:drainage-system = good
appearance :previous_crop_remainder = no

Output
Irrigation:quantity-first-leaching
Irrigation:quantity- second-leaching
Irrigation:quantity-first-leaching
nematode_op
downy-mildew_op
Fungi_spiders_op
spraying-the-nursery-before-transplanting
washing-the-plastic-cover
disinfection_of_plants_and_plastic
collect-irrigation-lines
plowing,
basins
first-leaching
adding-organic-manure
adding-chemical-fertilizers
ridging
second-leaching
plastic-tunnel-disinfection
irrigation-system-establishment
washing-and-testing-the-irrigation-system
installing-nets
irrigation-to-field-capacity
transplanting
plant-protection-after-transplanting
ventilation
pruning-and-training
avoid-high-soil-moisture
rottary-plowing

**Case 4**

**Input**
Current date = 1/12/2002
plantation:date = 25/12/2002
soil:ec=1.5
soil:ph=9
plant:rd
plantation:area
plantation: soil sterilization = not exist
last_infection:nematode-exist=yes
last_infection:analysis-nematode=yes
last_infection:analysis-nematode-status=low
last_infection:fungle-exist=no
plant:season = winter
appearance :weed_exist=no
plantation: mulch-used = no
soil:type = coarse
climate:wind = no
plantation:drainage-system = good
appearance :previous_crop_remainder = no

**Output**
Irrigation:quantity-first-leaching
Irrigation:quantity- second-leaching
Irrigation:quantity-first-leaching
nematode_op
downy-mildew_op
Fungi_spiders_op
spraying-the-nursery-before-transplanting
waching-the-plastic-cover
disinfection_of_plants_and_plastic
collect-irrigation-lines
plowing,
basins
first-leaching
adding-organic-manure
adding-chemical-fertilizers
ridging
second-leaching
plastic-tunnel-disinfection
irrigation-system-establishment
washing-and-testing-the-irrigation-system
installing-nets
irrigation-to-field-capacity
transplanting
plant-protection-after-transplanting
ventilation
pruning-and-training
avoid-high-soil-moisture
ditching
adding-sulphur

**Case 5**

**Input**

Current date = 1/3/2002
plantation:date = 10/3/2002
plantation: soil_sterilization = exist
last_infection:nematode-exist=no
last_infection: fungal -exist=no
plant:season = *early summer*
appearance :previous_crop_remainder = no
appearance :weed_exist=no
plantation: mulch-used = no
plantation:drainage-system = good
soil:type = fine
soil:ec=1.5
soil :ph= 4
climate:wind = no

**Output**

Irrigation:quantity-first-leaching
Irrigation:quantity- second -leaching
Irrigation:quantity- third -leaching
Fungi_spiders_op
avoid-late-irrigation
avoid-afternoon-spraying
install-drainge-system
disinfection_of_plants_and_plastic
collect-irrigation-lines
plowing,
basins
first-leaching
adding-organic-manure
adding-chemical-fertilizers
ridging
second-leaching
plastic-tunnel-disinfection
irrigation-system-establishment
washing-and-testing-the-irrigation-system
installing-nets
irrigation-to-field-capacity
transplanting
plant-protection-after-transplanting
ventilation
pruning-and-training
avoid-high-soil-moisture
Appendix

Introduction
This appendix include the different between the source code and The design. Its depends on "Detailed Design of The Cucumber Production Management Under Plastic Tunnel Expert Systems (CUPTEX) Version 3.0. (TR-88-024-43) " and “Amendment of Treatment & Plant Care Subsystems of CUPTEX”, (TR-88-024-48).

Relation between concept
- The following concept does not exist in the design:-
  - defer_irrigation_date inherits from Condition_preparation_op.
  - steam inherits from plastic_tunnel_ sterilization.

Concepts Properties
- The following properties for chemical_op concept does not exist in the design:-
  - mod_of_entry
  - number/1.

Relations Between Expressions
- Plantation: satus_value AND Last_Infection: status_value ENABLE Disorder:status_value
  - The material vydate in design is replaced by vydate (liquid) in implementation.
  - The property after_cult_period for concept last infection in design is replaced by the property after_cult_period for concept plantation in implementation.

- Last_infection:status_value AND Soil:state-value AND Plantation DETERMINE Agriculture_Operation:status_value
  - R5 contain the condition ‘nematode_exist :: last_infection = no’ in the implementation does not exist in the design.
  - R9 in implementation does not contain condation ‘last_infection .analysis_fungal = no’ which exist in the design.
  - Rule 1 in page 16 in the amendment not implemented

- Last_infection:status_value AND Plantation:state-value AND Plant DETERMINE Agriculture_Operation:status_value
  - Rules r1 in the design does not exist in the implementation.

- Plantation:state-value AND Disorder:status-value DETRMINE Agriculture-Operation:status-value
  - Rule r2 in the design does not exist in the implementation.
• Agriculture-op:state-value AND Plantation:status-value DETERMINE Agriculture-Operation:status-value
  o All rules contain the condition “clause(soil_steri_will_use1,_) ; clause(soil_steri_will_use2,_)” in the implementation, which does not exist in the design.

• Climate:status-value DETERMINE Agriculture-Operation:status-value
  o The agriculture_op takes the value “get_ride_of_sand_or_dust” in the implementation instead of “sand-or-dust-accumulation-on-plants” in the design.

• Agriculture_Operation:status_value DETERMINE Preparation_Operation:status_value
  o The rule for adding_chemical_material in the design does not exist in the implementation.
  o The method(8) contains the text ‘The quantity of water (Ltr/area) is :’ in r9 in the implementation does not exist in the design.
  o The method(21) contains the text ‘Leaching’ in r18 in the implementation instead of ‘third_leaching’ in the design.

• Agriculture_Operation:status_value AND Plantation:state-value DETERMINE Preparation_Operation:status_value
  o The condition ‘soil_steri_will_use1 :: plantation = solarization ; soil_steri_will_use2 :: plantation = solarization’ exist in r1 in the implementation but it does not include in the design.
  o The soil_steri_will_use1 and soil_steri_will_use2 property exist in the implementation but not exist in the design.

• Chemical_Operation:status_value DETERMINE Chemical_Operation:status_value
  o Rules r1, r2 conclusion “chemical_op:method = “soil drench” is not exist in the implementation.
  o Rules r1 material is vdate in the design, but it is vdate (liquid) in the implementation.
  o Rules r3, r4 in the design do not exist in the implementation.

• Agriculture_Operation:status_value AND Plant:state-value DETERMINE Non_Chemical_Operation : status_value
  o Method 41-a, 41-b, 41-l contain ‘Close the top openings during rainfall and fog.’ In the implementation which does not exist in the design.
  o ‘2- Use sharp knife or sciasor.’ is deleted from methods from 42a to 42e.

• Non_Chemical_Operation:status_value AND Plant:state-value ASSIGN Non_Chemical_Operation : status_value
• This relation is implemented with the 
  Agriculture_Operation:status_value AND Plant:state-value
  DETERMINE Non_Chemical_Operation : status_value relation.

• Table 2
The material quantity is totally different in the design from the implementation. Also
there is a records in the implementation which do not exist in the design, and versus.

<table>
<thead>
<tr>
<th>Week No</th>
<th>quantity</th>
<th>Season</th>
<th>quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>500</td>
<td>spring</td>
<td>750</td>
</tr>
<tr>
<td>2</td>
<td>750</td>
<td>spring</td>
<td>2000</td>
</tr>
<tr>
<td>3</td>
<td>1000</td>
<td>spring</td>
<td>3000</td>
</tr>
<tr>
<td>4</td>
<td>1250</td>
<td>spring</td>
<td>3000</td>
</tr>
<tr>
<td>5</td>
<td>2000</td>
<td>spring</td>
<td>3000</td>
</tr>
<tr>
<td>6</td>
<td>2500</td>
<td>spring</td>
<td>3000</td>
</tr>
<tr>
<td>7</td>
<td>3000</td>
<td>spring</td>
<td>3000</td>
</tr>
<tr>
<td>8</td>
<td>3000</td>
<td>spring</td>
<td>3000</td>
</tr>
<tr>
<td>9</td>
<td>3000</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>3000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>3000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Season</td>
<td>Value</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>--------------</td>
<td>--------</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>'early autumn'</td>
<td>3000</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>'early autumn'</td>
<td>3000</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>'early autumn'</td>
<td>3000</td>
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<tr>
<td>8</td>
<td>'early autumn'</td>
<td>3000</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>'early autumn'</td>
<td>3000</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>'late autumn'</td>
<td>750</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>'late autumn'</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>'late autumn'</td>
<td>3000</td>
<td></td>
</tr>
<tr>
<td>4</td>
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</tr>
<tr>
<td>5</td>
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<tr>
<td>8</td>
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</tr>
<tr>
<td>9</td>
<td>'late autumn'</td>
<td>3000</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>'late autumn'</td>
<td>3000</td>
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</tr>
<tr>
<td>1</td>
<td>winter</td>
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<tr>
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</tr>
<tr>
<td>3</td>
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<td></td>
</tr>
<tr>
<td>4</td>
<td>winter</td>
<td>3000</td>
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</tr>
<tr>
<td>5</td>
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<td>6</td>
<td>winter</td>
<td>3000</td>
<td></td>
</tr>
<tr>
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<tr>
<td>8</td>
<td>winter</td>
<td>3000</td>
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</tr>
<tr>
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<td>3000</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>winter</td>
<td>3000</td>
<td></td>
</tr>
</tbody>
</table>

**Inference Layer**

- The instantiate knowledge sources contain the Method “agr_op_pla_determine_pre_op” in the implementation, which not exist in the design.