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EXPERT SYSTEM IN THE USE OF BIO-REGULATORS FOR GRAPE CROP

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ABSTRACT: - This article presents the development of a rule based expert system in the use of bio-regulators for grape crop. Bio-regulator or Plant growth regulators play an important role in grape crop. Plant growth regulators are necessary for better quality grapes.

This rule based expert system will help the grape growers, agricultural experts and professional to apply exact doses of bio-regulators to grape crop throughout its various life cycle stages. On the basis of information like reason behind use of bio-regulator (i.e. for better panicle growth or for berry growth) and grape crop period, this system will suggest bio-regulator treatment.

Keywords: - Rule Based Expert System, Bio-regulator, Panicle and Berry Growth, Production Rule etc.

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1. INTRODUCTION:

An expert system is a computer program that contains the knowledge and analytical skills of one or more human experts. The most commonly known type of knowledge based system is the rule based expert system in which the experience and knowledge of human experts is captured in the form of IF-THEN rules and facts which are used to solve the problems.

Plant growth regulators are necessary for better quality grapes. To achieve the better results the stage and optimum concentration of Bioregulators are very important because the less or overdose causes no effect or even adverse effects on the quality of berries. Therefore it is necessary to use Bioregulators judiciously in grape vines. These are used for fruit bud differentiation after back pruning to control vigor of shoots, for elongation of rachis, berry growth and development etc. Different Bioregulators are used at different stages of grape crop. These are hydrogen Cyanamide, 6BA, Gibberallic Acid 3 (GA3), Urea Phosphate, Forchlorfenuron (CPPU) 0.1% L, Calcium Nitrate etc.

2. WHY USE BIO-REGULATORS IN GRAPE CROP? :

Bio-regulators are used for many purposes in grape crop. These are

- To maintain uniform size of berries in a bunch.
- To increase berry size and shape.
- To have a uniform color of berries.
- For berry thinning.
- To increase shelf life of grapes
- To delaying harvesting time etc.

3. OBJECTIVES OF THE STUDY:

The proposed study is undertaken with specific objectives as under-

1. To study the different factors related to bio-regulator management in grape crop.
2. To extract the knowledge of experts regarding problems related to grape crop.
3. To design & develop the rule base.

4. SCOPE OF THE STUDY:

The analysis is done as per objectives of the study. There are two types of grapes like table grape & wine grapes. The present study has been confined to an application of expert system in the management of table grape crop. The present study has been confined with the use of inorganic Bio-regulators used for grape crop. The conceptual scope confined with the life cycle stages of grape crop and the analytical scope has been confined with the algorithms, and expert system rule base. The study carried out only in Satara and Sangli districts.

5. RESEARCH METHODOLOGY:

Method of Research:

Researcher intended to carry out his research is "Applied Research". Applied research aims at finding a solution for an immediate problem facing a society. In current research, researcher developed an expert system which address to the problem facing by grape growers and agricultural professionals.

Data Required:

For this study, researcher requires data related with the different varieties of grapes, life cycle stages of grape crop, ratio and combinations of Bio-regulators applied for grape crop. To collect this required data, researcher used following sources.

In this study, researcher has selected both primary as well as secondary data.

Primary data is directly collected from respondents. In this study, grape growers and agricultural academicians, professionals & research persons are respondents. The primary data collected was through Schedule provided to grape growers and agricultural academicians, professionals & research persons.

The grape growers are grouped into strata on the basis of educational qualification i.e. who posses degree in Agriculture & whose current profession is Agriculture (growers of grapes) & conventional grape grower. The researcher collected information and numbers of such grape growers from Maharashtra Rajya Draksha Bagayatdar Sangh, Pune Section: Sangali.

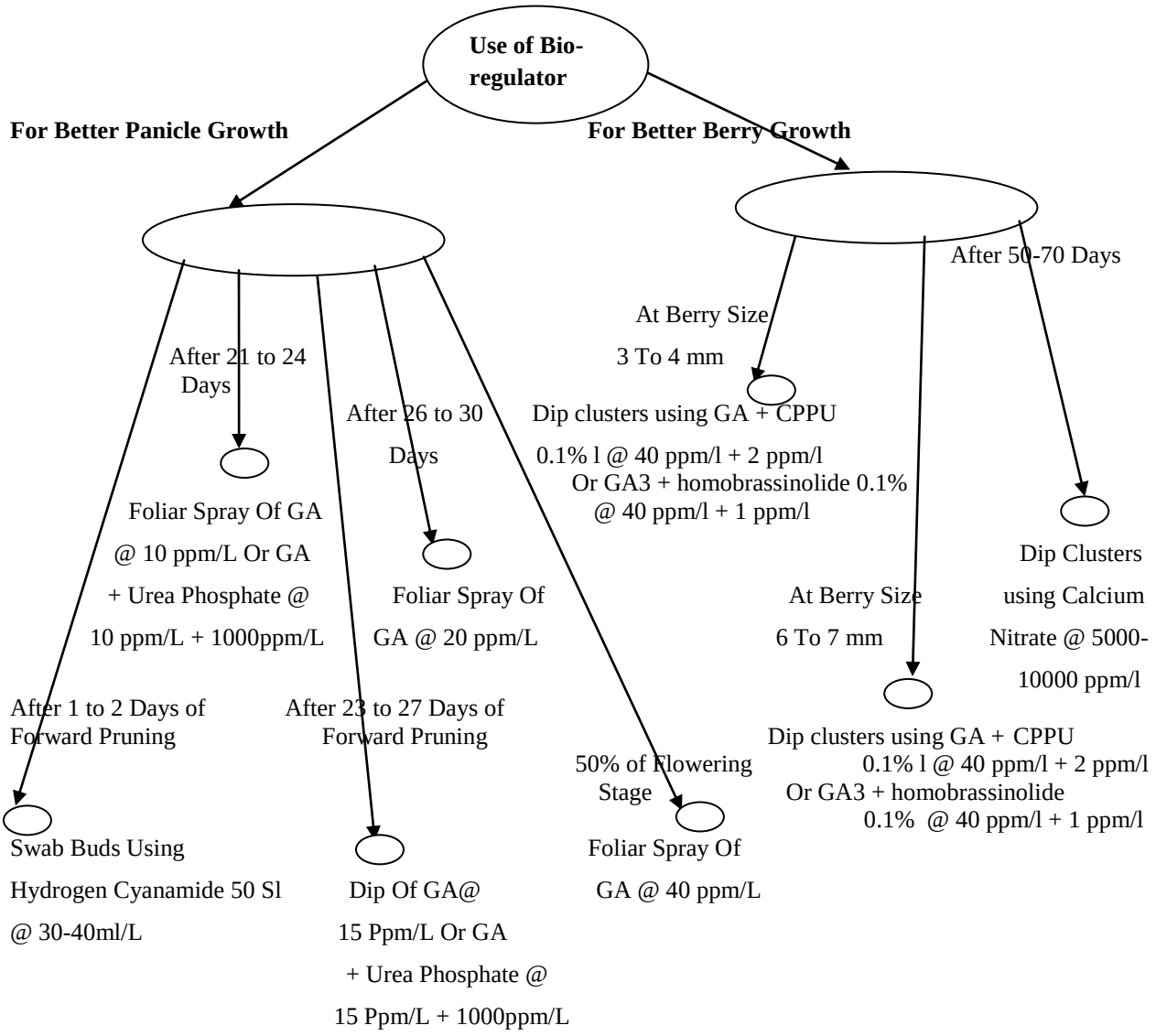
Also in case of Experts i.e. agricultural academicians, professionals & research persons, such experts are selected from six Agriculture Degree colleges, fifteen Agriculture Diploma colleges, three Krishi Vidnyan Kendra, and National research centre for grapes pune. The numbers of respondents are selected by using convenient sampling.

Secondary data were collected through various agricultural books, journal, diaries published by agricultural universities, newspapers, articles published by national research center for grapes etc.

6. BIO-REGULATOR MANAGEMENT IN GRAPE CROP:

To have an export quality grapes, use of bio-regulators are essential because it helps grape growers to increase berry size and shape, to increase shelf life and to have a uniform green color. Gibberallic Acid GA3 and Forchlorfenuron (CPPU) 0.1% L are used to increase the berry size of grapes whereas at the time of 50% flowering stage, only GA3 at 40 ppm are used to thin unwanted berries. Harvesting may be delayed with the help of bio-regulators. To delaying harvest time by 7 to 10 days Forchlorfenuron (CPPU) 0.1% L are used.

Following figure shows use of bio-regulator after forward pruning.



7. RULE BASE DEVELOPMENT :

The rule based system uses rules in the form of IF-THEN. The IF part needs to be satisfied by the facts for the goal i.e. to fire the THEN part. The knowledge base is a collection of knowledge in the domain area. Here domain is to suggest use of Bio-regulator. In this paper, expert knowledge is acquired in the form of If-then rules to suggest use of Bio-regulator on the basis of input given by the user. End user enters information like type of pruning, reason behind applying

Bio-regulator (i.e. for better panicle growth or for berry growth) etc. The prototype model will accept this information and suggests different Bio-regulator treatments.

Each rule has a left hand side and a right hand side. The left hand contains information about certain facts and objects which must be true in order for the rule to potentially fire i.e. execute. Any rules whose left hand sides match in this manner at a given time are placed on an agenda. Then right hand side is executed and finally it is removed from the agenda. The agenda is then updated and new rule is picked to execute. This continues until there are no more rules on the agenda.

Following rules illustrates how the knowledge base has been represented in the form of 'IF-THEN' rules.

8. RULE BASE SYSTEM IN THE USE OF BIOREGULATOR : -

For the goal driven forward chaining expert system, the final goals are: suggesting proper ratio of Bioregulators. Anyone can have 8 resulting combinations (If-then rules in Rule base), based on which he/she decide which Bio-regulator should be used at which stage. The system ultimately has to reach one of these goals after processing all the parameters under each rule to complete the evaluation process and provide the final decision about the use of bio-regulator. On which system suggest appropriate ratio of Bio-regulator.

Following rules represents the expert's knowledge in the form of IF-THEN rules.

RULE #1

IF USE OF BIO-REGULATOR IS FOR BETTER PANICLE GROWTH

AND GRAPE CROP PERIOD IS 1 TO 2 DAYS OF FRUIT OR FORWARD PRUNING

THEN

SWAB THE BUDS USING HYDROGEN CYANAMIDE 50 SL @ 30-40ML/L

RULE #2

IF USE OF BIO-REGULATOR IS FOR BETTER PANICLE GROWTH

AND GRAPE CROP PERIOD IS 21 TO 24 DAYS OF FRUIT OR FORWARD PRUNING

THEN

FOLIAR SPRAY OF GIBBERELLIC ACID (GA) @ 10 PPM/L

OR GIBBERELLIC ACID + UREA PHOSPHATE @ 10 PPM/L + 1000PPM/L

RULE #3

IF USE OF BIO-REGULATOR IS FOR BETTER PANICLE GROWTH

AND GRAPE CROP PERIOD IS 23 TO 27 DAYS OF FRUIT OR FORWARD PRUNING

THEN

DIP OF GIBBERELLIC ACID (GA) @ 15 PPM/L

OR GIBBERELLIC ACID + UREA PHOSPHATE @ 15 PPM/L + 1000PPM/L

RULE #4

IF USE OF BIO-REGULATOR IS FOR BETTER PANICLE GROWTH

AND GRAPE CROP PERIOD IS 26 TO 30 DAYS OF FRUIT OR FORWARD PRUNING

THEN

FOLIAR SPRAY OF GIBBERELLIC ACID (GA) @ 20 PPM/L

RULE #5

IF USE OF BIO-REGULATOR IS FOR BETTER PANICLE GROWTH

AND GRAPE CROP PERIOD IS 50% FLOWERING STAGE

AND IF USING PREVIOUS APPLICATION OF GA RACHIS ARE NOT ELONGATED ENOUGH

THEN

FOLIAR SPRAY OF GIBBERELLIC ACID (GA) @ 40 PPM/L

RULE #6

IF USE OF BIO-REGULATOR IS FOR BERRY GROWTH

AND BERRY SIZE IS 3 TO 4 MM

THEN

DIP CLUSTERS USING GIBBERELLIC ACID (GA) + FORECHLOREFENURON (CPPU) 0.1% L @ 40 PPM/L + 2 PPM/L

OR GA3 + HOMOBRASSINOLIDE 0.1% L @ 40 PPM/L + 1 PPM/L

OR GA3 + 6BA @ 40 PPM/L + 10 PPM/L

RULE #7

IF USE OF BIO-REGULATOR IS FOR BERRY GROWTH

AND BERRY SIZE IS 6 TO 7 MM

THEN

DIP CLUSTERS USING GIBBERELLIC ACID (GA) + FORECHLOREFENURON (CPPU) 0.1% L @ 30 PPM/L + 2 PPM/L

OR GA3 + HOMOBRASSINOLIDE 0.1% L @ 30 PPM/L + 1 PPM/L

OR GA3 + 6BA @ 30 PPM/L + 10 PPM/L

RULE #8

IF USE OF BIO-REGULATOR IS FOR BERRY GROWTH

AND CROP PERIOD IS 50 TO 70 DAYS OF FRUIT PRUNING OR BEFORE VERAISON STAGE

THEN

DIP CLUSTERS USING CALCIUM NITRATE @ 5000 TO 10000 PPM/L

Sample Rule:

Consider following rule from above rule base,

Rule #8

IF USE OF BIO-REGULATOR IS FOR BERRY GROWTH

AND CROP PERIOD IS 50 TO 70 DAYS OF FRUIT PRUNING OR BEFORE VERAISON STAGE

THEN

DIP CLUSTERS USING CALCIUM NITRATE @ 5000 TO 10000 PPM/L

Here forward chaining method is used to reach to the result. The available data is reason behind use of bio-regulator, crop life cycle (i.e. Foundation pruning). Hence Rule # 8 is selected, because its antecedent matches the available data. Now the consequent is added to data. Nothing more can be inferred from this information, but we have now accomplished our goal of suggesting Bio-regulator treatment for better berry growth. Thus forward chining is implemented here. In this way remaining rules are prepared.

9. CONCLUSION :

This Rule Based System is helpful to grape growers, agricultural professional and academicians to use Bio-regulator at different crop stage. So here grape growers get choice of selecting Bio-regulators by considering different companies and their prices. This expert system checked by grape growers as well as agricultural expert and initial feedback collected which have been positive. With further work, the scope of the expert system can be widened.

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