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TRADITIONAL METHODS IN THE MANAGEMENT OF PLANT DISEASES - A REVIEW

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ABSTRACT

Traditional method, form the basis of management of plant diseases in low input situations. The ancient Indian literture documents use of plant products, animals products and wastes for curing the diseases of human beings and plants. The research efforts made on managing panama disease of banana using modified panchavya mixture has shown the promise of the systems. Literature available on the topic is presented in an abridged form.

Plant diseases are a major source of yield reduction. There are about 1000 diseases which affect economic crop plants causing significant damages. Majority of plant diseases are caused by fungi followed by viruses, bacteria, nematodes and a number of other plant pathogens. Imbalance of nutrients and extreme variation in environmental factors also leads to serious plant diseases. Integrated management of these diseases needs of synergy with the natural environment. Traditional agricultural practcies were tailor made to maintain this synergy and from the basis for plant disease management.

Traditional agriculture is usually associated with pre-industrial peasant agriculture. Indigenous knowledge is the ".. largest single knowledge source not yet mobilized in development enterprise.." India has a treasure of indigenous knowledge concerning plant health, developed and documented several centuries ago. The three major ancient texts *inter alia* are:

(1) Varahamitra, 505 A.D., *Brihat Samhita*, *Vriksshayurveda* Part 1, chapter 55 (edited by M. Ramakrishna Bhat, Motilal Banarasidas, Bangalore, India, 1950).

(2) Chavudaraya, 1025 A.D. *Lokopakaran*, *Vriksshuauveda*, chapter 6 (edited by H. Shesha Iyenger, Government Central Manuscripts Library, Madras, India, 1950).

(3) Sarangadhara, 1363 A.D., *Vriksshayurveda* (edited by S.K., Ramachandra Rao, Kalpatharu Research Academy, PO Box 1857, Bangalore, 1993, India).

The most detailed of all the *Vrikshayurveda* work, seems to be that of Chaundaraya, 1025 A.D. It is however to be noted with caution that the development of this body of knowledge need to be viewed in pest-disease scanario prevalent 10 to 15 centuries ago, during which many of the current pests/diseases may not have existed. However, the methods employed have common characteristics such as (1) Multi pronged attack on the pest/disease (2) improving plant heatlh thereby increasing resistance capability (3) Enriching soil with and buffering useful microbial activity and (4) Broad spectrum effects on pest/diseases which are desirable.

Certain details as under, though these may not be necessarily practicable at this point of time.

1. A few indigenous method of plant protection as outlined in ancient texts.
2. The documentation of research endeavor in a few indigenous knowledge practices.
3. Local practices adopted for plant disease management.
4. Policy implications.

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1. A few indigenous methods of plant protection in ancient texts

Esteemed authors of the ancient texts, make a mention of the painstaking efforts they have taken while observing and researching on indigenous methods that have documented. In this paper mainly methods of disease control are highlighted.

The following methods are drawn from *Lokopakara*, Chapter VI - *Vrikshayurveda*.

a) Disease Avoidance (as in 12th stanza)

The incense of *Embelia ribes Burm* (Vayuvilanga) fam: Myrsinanceae). *Commiphora wightii* (Mahishakshi) fam: Burseraceae), fish meat, *Curama longa* (asisna) (fam: Zingiberaceae), *Brassica nigra* (Sasuve) fam: Brassicacea) flowers of *Terminalla tomentosa* (mathi) (fam: Combretaceae), will provide resistance to plants against diseases.

If the growing tips of plants dry up or set broken or get whitened such plants are inferred to have been affected by disease. In the affected plant, warm ghee has to be smeared and black soil applied to combate the disease.

The following methods are drawn from *Brihat Samihitha*, Part 55, Chapter VI, *Vrikshayurveda*.

b) Seed treatment

The seeds need to be soaked in cow's milk for ten days. Every day they have to be taken out with palms greased with cow ghee. Later, they are rolled in cowdung mixed with flesh of deer and hog. Later, they are treated with the flesh and marrow of hog. Thus treated seeds are planted in the soil treated with sesamum. The seeds sown are to be sprinkled with milk and water.

c) Disease treatment

The ulcers in affected trees be removed with knife. A paste made using *Embelia ribes* (Vayurlanga) fam: Myrisinaceae), cow's ghee and silt be applied to the affected parts and later be sprinkled with water and milk.

The following methods are drawn from *Vrikshayurveda* of Sarangadhara.

The pathological conditions of wind (Vata), bile (Pitta) and phlegon (Kapha) which are responsible for diseases in human beings are causes of disease in plants also. When trees are affected by pests, affected parts are to be removed. The disease due to vata (Wind) are overcome by application of clarified butter and fresh juice, that due to bile is overcome with substances that are cold mixed with water, and that due to kapha (Phelra) are cured with substances which are acidic mixed with hot water or pungent and bitter substances.

Plants attacked by pests are to be treated with mixture of fresh cow urine, clarified butter, *Embelia ribes* Burm, mustard and Sesamum, applied to trunk and then are to be watered with milk and water.

Trees which are attacked by any type of pests are to be treated with the paste from bark of *Pongamia glabra* (Honge) (fam: Fobaceae), *Cassia fistula* (Kakkagida) (fam: Caeslapiniaceae), *Sapindus laurifolius* (arishta) (fam: Sapindaceae), *Alstomia scholaris* (Saptaparni) (fam: Apocynaceae), *Embelia ribes* Burm (Vayuvilanga) (fam: Mysinaceae) and *Cyperus esculentus* (Tengamurte (fam: Cyperaceae) in cow's urine.

Exudation from trees can be stopped with application of bark paste of *Setaria italica* (Priyangu/Navane) fam: Poaceae) and *Temindelia arjuna* (arjuna), (fam: Combretaceae) in boiled milk.

Surapala in Vriksahyurveda suggested measures of treatment of plant diseases.

Trees that grow too close and touch each other do not yield adequate fruit owing to their roots entwining and injuring each other, so recommended appropriate plant to plant distance as applicable to individual species should be followed. Disease like the scoring of leaves, arrest of the growth of leaves, drying up of branches and excessive exudation of sap have

recommended remedies like clearing of the diseased part and then plastering them with the paste of vidanga and ghee and nurturing them with water mixed with milk.

Cessation of fruit bearing (i.e. sterility) is curred by kulattha, masa, murdga sesamum and barley.

Traditional farming practices in the past have often provided effective and sustainable means of disease control. Most of the present practices and cultivars have been avoided from the ancient techniques and planting materials. To control diseases they practiced careful seed selection, crop rotation and avoided planting when the moon was full or the sun had a halo. In general, most practices of traditional farmers for disease management included cultural control. Some practices of traditional farmers were altering plant and crop architecture, biological control, fresh burning, adjusting crop density or depth or time of planting, planting diverse crops, fallowing, flooding, mulching, multiple cropping planting under zero tillage, using organic amendments, planting in raised beds, rotations, sanitation and tillage. Most but not all are sustainable.

2. Documentation of research endeavor in indigenous plant protection in UAS, Bangalore

In general, managemnt of soil borne diseases is very difficult particularly, Fusarvium pathogen which is a soil inhabitant and remains viable for 50 years in the soil. Hence, it is difficult to manage this pathogen by any methods including cultural methods.

The cow milk, curd, ghee, cowdung and cow urine have been individually used as plant protection protocols as prescribed in ancient "*Vrikshayurveda*" texts (concerning health of plants/trees). It is know that cow ghee and curd are toxic to certain living entitles and in addition curd is acidic. The '*Panchagavya*' five products of cow (milk, curd, ghee, dung and urine) is supposed to be consumed in a little quantity by persons who need to get purified before performing certain Pooja. The innovative research on use of modified Panchagavya mixture (MPG-3) was carried out on two soil borne disease like Fusarium wilt of tomato and Panama disease of banana. The traditional Panchagavya was modified by adding yeast and common salt and three formulations were tested. The components of MPG-3 100 ml preparation for 2 ml cow's ghee, 5 ml of milk, 5 ml of curd, 40 g dung and 48 ml of urine mixed with 2 g yeast and salt.

The components of MPG were fermented for seven to ten days in closed plastic container and stirred everyday for 10 minutes. The addition of salt is to reflect Jim Martin's living water promoting microbial activity which is further augmented with addition of yeast.

The fermented preparation was diluted ten times with water and filtered through two layers of muslin cloth to obtain clear filtrate. The filtrate was used for dipping seedlings for 30 minutes and for drenching the soil pre infested by the pathogen in the experiments.

In case of Panama disease of Banana, MPG-3 was used at 10^1 dilution along with different bioagents like *Trichoderma viride* (0.25%). *Pseudomonas fluorescens* (1 hour dip, 10^8 cells/ml), *Bacillus subtilis* (hour dip, 10^6 cells/ml). The MPG-3 gave better influence on plant height, number of leaves, maximum root length and pseudostem girth etc. There was reduction in *Fusarium* population in MPG-3 treated pots. Soil application of MPG-3 provided encouraging results compared with seedling dip. The population of *F.o.f.sp. cubense* declined significantly to 11.8×10^4 cfu/g after 150 days of planting. These results indicate the promise shown by MPG-3 in the ecofriendly and cost effective management of *Fusarium* wilt.

3. Some classical examples of local practices adopted for plant disease management

- Shade regulation for coffee leaf rust and

blister blight of tea.

- Growing wind brakers like silver oak, casurina, jack, etc. to avoid sun scorching of young shoots of plantation crops.
- Tieing for arecanut seedlings with coconut and arecanut fronds to protect them from western sun scorching.
- Pasting of lime on areca trees to avoid ill effect due to sun scorching
- Watering nursery beds during early morning for higher seedlings vigour and stand particularly followed in chilli and brinjal.
- Burning nursery with leaf litter and farm waste to overcome certain soil borne pathogens.
- Raised beds, fields and ridges used to manage some soil borne pathogens. In mexico raised beds called "Chinampas or floating garden" were used to control *Phythium*, *Phytophthora* and other soil borne pathogens.
- Collection and burning of stubbles in the field to over come the problem of soil borne pathogens.
- Flooding with water to overcome the problem of soil borne pathogens by creating anaerobic conditions. In our studies flooding for 85 to 100 days brought down significantly the *Fusarium oxyporum f.sp. cubense* population causing Panama disease of banana.
- Earthing up to over come the problem of *Pythium* damping off in nursery in brinjal and tomato.
- Kotte tieing for area bunches to over come problem of koleroga of arecanut.
- Planting across the wind direction to over come the problem of some airborne disease
- Mixed cropping of jowar with tur to prevent movement of mites which transmits sterility mosaic of pigeonpea and to minimise tur wilt.
- Manipulation of planting time/date of sowing to over come problems of some foliar diseases, et. Tikka disease of groundnut, anthracnose of chilli.
- Summer ploughing to reduce the problem of nematode infestation and soil borne pathogens.
- Magi cultivation : Crop rotation with legume cereals and millets to over come problem of soil borne pathogens.
- Mulching with green manure in paddy to over come the problem of soil borne disease.
- Liberal application of organic amendments, oilcakes in different crop to manage soil borne diseases.
- Salt water treatment for wheat to over come the problem of seed borne diseases eg. Bunt and seed gall in wheat.
- In North Costarica, traditional farmers in many areas used a system called "frijol tapada" meaning "Covered beans", a combination of mulch and bean plants effectively prevented the spread of web blight of beans.
- Benching of maize earheads downwards in Mexico to over come the seed borne infestation due to fungal pathogens.
- Tieging of paddy thread prepared out of hay near the crown region of coconut and placement of 1 kg of salt on it to over come the problem of stem bleeding.

4. Implications

Plant protection experts all over the world are beginning to evince keen interest in indigenous methods of plant protection. With this knowledge being made available, research endeavours may be oriented towards validation of indigenous methods encouraging integrated disease management (IDM) practices. Indigenous knowledge by itself cannot be a sole method of management but its integration with modern method would surely pave the way for effective management of diseases without affecting the natural ecosystem adversely.

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