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ELECTROSTATIC SPRAYING IN AGRICULTURE: AN ENVIRONMENT FRIENDLY TECHNOLOGY

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Electrostatic liquid spraying has been successfully used in many industrial applications such as painting and pesticide spraying because electrostatic space charge and image deposition forces enhance the uniformity of spray on target surface and increase the transfer efficiency and adhesion. Electrostatic spray technology has superior performance in improving droplet size, size distribution and deposit rate on targets, adsorption, and uniformity. The electrostatic spraying technology is based upon induction charging. It has low charging voltage, and this method is the safest of the others. Insulation is easy to implement because the electrodes of the sprayer and the droplets are separated. Figure 1 shows the basic components of an electrostatic sprayer. The anode grounding and the negative electrode of the electrostatic generator combine with annular electrodes. The pesticide pumped from the tank through a nozzle forms droplets. The electric field between the electrode and the liquid jet charges the droplet induction. The negative charge of the droplets can be attributed to the attraction to positively charged objects, which facilitates directional movement adsorption on the surface of the target.

Fig. 1

The conventional high volume spraying is labor intensive and time consuming process. The hydraulic nozzles produce wide spectrum of spray droplets and more than 40 -60% of sprayed pesticide does not really deposit on the foliage. Neither the very small drops nor very big drops are useful due to drift and run off problems. The Controlled Droplet Application (CDA) method improves pesticide deposits and lower application volumes of less than 5 L/ha can be achieved. The ULV application method has serious problem of pesticide drift too. The electrostatic spraying system reduces the application volume substantially and greatly improves pesticide deposits. The liquid atomization is achieved by utilizing electrostatic forces. The spray particles of about 50 µm size having high electrostatic charge are issued from the nozzle. It is reported that the depositing increases by three times, or more. This system has great potential. By imparting electrostatic charge to spray droplets of hydraulic nozzles and spinning disc nozzles also depositing improves much.

The basic principle of electrostatics is like charges repel, and dissimilar charges attract. With electrostatics, a high electrical positive or negative charge is applied to a liquid or aerosol substance; as the charged substance is sprayed, it is pulled like a "magnet" towards the intended surface, which it precisely and completely surrounds with 360° coverage. Because the electrostatic process directs the liquid or aerosol product towards the opposite surface instead of wasting overspray in the environment or air, it is both an efficient and effective way of applying a product. Electrostatic ally charged material that would normally miss the intended surface will now be attracted to the edges and backside of that surface. This is commonly referred to as the "wrap around" effect.

High electrostatic field, as a feasible and non-chemical technique, applied to food preservation is a new area of study. Electrostatic forces of attraction have been incorporated to provide an improved method for efficiently applying protective sprays onto postharvest fruits and vegetables. Control measures by chemical, biological, and physical means are routinely used to reduce food losses attributable to spoilage microorganisms and preclude mycotoxins. There are numerous advantages of electrostatic spraying technology as compared to conventional spraying (Figure 2).

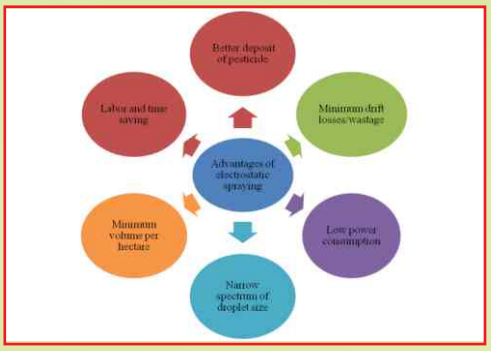

Fig. 2

Since controlled-atmosphere storage modifies the temperature, humidity, and gaseous composition within storage and shipping containers to conditions arresting the growth of harmful microorganisms, whereas feasible, chemical fumigation is relied upon for inactivating surface molds and other food-borne pests within air-tight enclosures. Often, however, postharvest agricultural produce such as fruits and vegetables must be treated openly at some stage along the processing or packing line prior to

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ICT BASED TOOL FOR DECISION MAKING IN INSECT/PEST MANAGEMENT OF MANGO

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In the last 50 years a lot of research has been done in field of Agriculture, which has not been properly extended to the farmers. Information technology could be applied to as a means in extending the research works done by the ICAR institutes and SAU's. In the past, say prior to 1950, agriculture/horticultural production relied strongly on integrated systems and non-synthetic pesticides. This knowledge was put aside in the euphoria of new discoveries, the availability of new techniques such as mineral fertilizer, synthetic pesticides etc enabled farmers to compensate quickly for any deficits in their cropping technology. Hardly any research was invested in finding "softer", more environmentally-friendly and sounder production methods until the severe impacts of high input agriculture on farmers, consumers and the environment became obvious. The emergence of information and communication technologies (ICT) tools allows capitalizing to a greater extent on the wealth of information and knowledge available for agriculture and in the last decade these tools have opened new avenues in agriculture that could play important roles in meeting the prevailing challenges related to sharing, exchanging and disseminating knowledge and technologies. Knowledge transfer in the fields of organizational development and learning is the practical problem of transferring knowledge from one part of the organization to another (or all other) part(s) of the organization. As National Research Centre for Integrated Pest Management has the mandate to develop database on all aspects of crops for the insect/pest management strategies. These tools provide a web-based decision support system (DSS) for national priorities insect and pest management to get the correct information on time. This can further increase the productivity and can help in the management of pests. Development of such system can equalize the communication and exchange of information among different research workers and farmers, and also to facilitate communication. Therefore, it is necessary to have a DSS for the important crops for different zones. Many decision support system, information system and expert systems have already taken place in ICAR system but a decision support system according to different Agro-climatic zones of India is not yet available for mango crop. Mango (*Mangifera indica* Linn) is the most important fruit of India and is known as "King of fruits". The fruit is cultivated in the largest area the largest area i.e. 2217 thousand ha and the production is around 18506 million tons. It is recognized as one of the choicest fruits in the world market for its excellent flavor, attractive color and delicious taste. It has medium calorific and high nutritional values. Mango is well adapted to tropical subtropical climate and hence grows well in dry-humid as well as dry climate. The major export varieties Kesar and Alphonso are produced in Gujarat and Uttar Pradesh tops the list of mango producing states with a production of 4309.54 thousand tons. As being the one of the most important agri-horti crop there is a need of web based information system for management of pests for different Agro-climatic zones of India which could be used to support the farmers in decision making, monitoring and controlling the insect/pests in mango fruit crop. Being a major producer, U.P. state is considered for data collection and field surveys at the initial level. The work involves creation of database on the basic parameters i.e. variety selection, cultural practices, disease diagnosis, insect identification, post harvest technology and pesticide application. The information on mango would be collected from various mango experts of the region through field survey and online resources and published literature, then would be compiled and feed into the database. Designing and creation is an important part of the system, which will be designed using PHP and backened using SQL server. Pest zonation maps will be prepared on the identification of the hotspots. The developed system would be tested and hosted on the NCIPM web server and hotspots will be utilized for the important pest management regions. The developed application could be accessed using Internet browser. As a result of the research work a web enabled decision support system on universal platform would be available for end users especially mango growers of the study region and and an online inbuilt pest advisory would be available for the consultation at the critical stages of pest/ disease infection in the crop. The developed DSS would be hosted on NCIPM website and will also be kept at NCIPM in the storage devices for distribution to farmers and extension departments, if required. The system extends large amount of research work done by the ICAR institutes to the Farmers in a scientific way. It enhances the efficiency of Agricultural Extension personnel. This way it helps in transfer of technology for increasing production and management of pest/disease in the mango crop. The development of "DSS for mango" will be a step forward in this direction, as it will revamp and vitalize the extension services in order to reach the farmers effectively.

MODERN ZOOS SERVING AS NOAH'S ARC FOR SAVING ENDANGERED SPECIES AROUND THE PLANET

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The perennial question that still revolves around the concept of zoos or zoological garden is whether it is moral and acceptable for humans to confine animals in cages for entertainment or education or awareness or captive breeding. Several respected and dedicated animal right activists around the planet have been demanding complete closure of zoos; and to set the animals back into their natural ecosystem and habitats or advocating for more progressive animal rights. On one end of this spectrum are conservationists, foresters, and ecologists who sincerely believe that zoos have n important role to play in educating the public and making them aware of the spectacular biodiversity of the plant so that the public become more caring and responsible towards conserving natural ecosystems and environment.

While the other extreme ends calls for freedom for animals and advocating for the animals to live and thrive in their own natural ecosystems and habitats; free from any confinement or cage or enclosure. They insist that no matter how progressive and animal friendly modern zoos are in their basic philosophies; and no matter how great the zoo infrastructure is for mimicking natural ecosystems; they can never be equal or anywhere near the quality of wild natural habitats. Hence any confinement in the zoos actually violates the right of a helpless and defenseless animal as an individual species co inhabiting the planet with us; and must be returned to the wild. The debate will continue as is expected in any democratic society; however, honestly speaking we could not possibly undermine the role of modern zoos in education and awareness of the public. Furthermore, we also can not under estimate the need for modern zoo facilities for the purpose of multiplication through captive breeding of several endangered species for the purpose of conservation as well as restoration of degraded natural habitats and ecosystems.

Traditional or conventional zoos have travelled a long distance over time in transforming into knowledge centers for animal health, nutrition, behavior and conservation. They have been serving as interpretation centers for better understanding of the delicate human-animal interactions and contributed greatly in the species conservation program through captive breeding around the planet. All these could not be achieved by releasing confined animals overnight into the wild. Furthermore, many zoo bred animals are completely cut of from their wild instincts and habitats for generations; and may not even be able to adapt to their natural ecosystems; and even die, thereby further compromising their dwindling numbers.

The knowledge gathered in the zoos and aquariums by dedicated keepers, curators, vets, breeders, ecologists, conservators and researchers over several centuries across different generations in closely studying wild animals like mammals, birds, reptiles and fishes could be actually used in saving them in the wild. To be successful in proper conservation of a species that is threatened or endangered or critically endangered in the wild; we need to know about them in detail. Zoos provide some if not all opportunities to know them intimately. That knowledge could be applied in saving the species in their wild habitats and ecosystems. Hence undermining the value of modern zoos for their role as Noah's arc for saving endangered species around the planet is not advisable and appreciable.

Several specie around the planet have been hit hard due to anthropogenic impacts like pollution, Global Warming and Climate Change, human encroachment into sensitive wildlife habitats, over exploitation of natural habitats, rampart poaching, demand for bush meat, trafficking of wildlife and wildlife body parts (like vital organs, glands and reproductive parts, fresh animal excreta, skin, fur, pelt, horns, nails, bones, skulls, scales etc) for illegal wildlife black markets as well as private zoos and entertainment parks, unmonitored forest fires, over grazing in restricted forested areas, diseases and infections, destruction of wildlife corridors for transboundary

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and migratory species to mention only a few. Under these circumstances several species of invertebrates and vertebrates, like insects, fishes, amphibians, reptiles, birds and mammals are showing signs of alarming decline beyond the point of natural recovery.

Many endangered or critically endangered species are suffering from genetic bottlenecks due to extremely small size of their populations; and need planed breeding for their future genetic vigor and stability based on modern animal breeding and genetics research. In some cases artificial insemination of the females are necessary to give birth as viable breeding males may or may not be available in the current populations or sub populations or existing males could have less genetic vigor or impacted with communicable diseases and hence genetically inferior for natural breeding purposes. Several endangered species have become so vulnerable in their natural ecosystems due to several anthropogenic factors as discussed above; and could not possibly survive in their natural ecosystems or habitats without human help. For others, the numbers have dwindled to such record low in centuries; that only safe breeding and multiplication in closed enclosure can help the species to survive.

All these scenarios need the support of the modern zoological gardens to bring the species back from the brink of extinction. Several successful examples of species revival through zoo interference can be cited around the planet like Asiatic cheetah, red panda, giant panda, snow leopard, clouded leopard, Siberian tiger, Malayan tiger, Indochinese tiger, Indochinese leopard, pangolin; as well as several species of birds, deer and antelopes, endangered rodents, primates, amphibians and reptiles. Hence in spite of many negative criticisms, the role of modern zoos or zoological gardens in helping to protect and conserve endangered species can not be under estimated at all.

Zoos around the world now collaborate, cooperate, communicate and compensate (4Cs) with one another in several multi-nation based captive breeding programs by exchanging genetic pools for generating high vigor individuals for stabilizing their genetic future. Young animals reared and saved through the zoos could then be released into their natural wild habitats. Zoos therefore can indeed serve as the biblical Noah's arc in multiplying, protecting and conserving several endangered species around the planet while serving as a tool for mass education and awareness regarding natural world for the public.

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shipment. Aqueous solutions or suspensions of fungicidal control agents are commonly sprayed by pressure nozzles onto the product for this purpose. Such spray applications utilizing hydraulically atomized droplets of large diameter are characterized by poor surface coverage, inefficient droplet deposition, and excessive rebound and runoff of spray liquid through drifting. Thus improvements are demanded based upon economic, environmental, and product-quality considerations. Now the time demands that spray equipment should be more efficient and safer for the environment and the handling person. The electrostatic spraying technology is proving as a boon for the farmer. In near future the role of such environment friendly technology will be very significant towards achieving sustainable agricultural development.