AGROHOMEOPATHY: AN EMERGING FIELD OF AGRICULTURE FOR HIGHER CROP PRODUCTIVITY AND PROTECTION OF PLANTS AGAINST VARIOUS STRESS CONDITIONS

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Abstract: Agrohomeopathy is one of the newest approaches in agricultural research. In recent years various scientific studies showed that potentised homeopathic medicines can alter physiological activities of plants. It can alter the rate of enzymatic activities, total sugar, protein and cholophyll contents in plants. Eradication of biotic and abiotic stresses upto some extent also made possible by the use of homeopathy. In case of biotic stresses-antifungal, anti-microbial,anti-insecticidal etc activities of various homeopathic drugs has been reported. Sometimes other path of abiotic stress (salt stress, drought stress,Cold Stress, Metal toxicity, Mechanical Damages etc.) control are costlier or less efficient. But proper selection of homeopathic drugs can be cost effective and very efficient in terms of abiotic stress tolerance in various crop species. The Similia principle of Christian Friedrich Samuel Hahnemann is also significant in plant model. Some researchers proved that Similia Principle is very useful to overcome abiotic stresses of plants.

Ultra high dilution of homeopathic medicines can be used safely for various purposes (Seed germination, betterment of soil health, growth of seedlings, flowering, fruiting, protection against diseases and to overcome environmental stresses). But precautionary measures (proper selection of homeopathic drugs and its potency, proper dilution of drug with water) must be taken before use of these drugs. Wrong drug selection can show detrimental effects on crops and it is believed that higher dilution of drugs (1:500 or 1:1000) with water is more effective for plants. Proper selection of drug and its potency, agrohomeopathy can be an efficient and very cost-effective alternative that can increase farmers' income by lowering the input cost of Chemical fertilizers and insecticides.

Keywords: Agrohomeopathy, Agriculture, Potency, Dilution.

Introduction: VD Kaviraj is a Dutch homeopath and pioneer in Agrohomeopathy. He is the author of the book "Homeopathy for Farm and Garden". After his tremendous work on Agrohomeopathy, the subject become a matter of scientific research. Agrohomeopathy is chemical less and non-toxic method for crop cultivation. Agrohomeopathy can make plants resistant to diseases and pests by strengthening them in every possible way.

Agrohomeopathy is the specialized area of homeopathic practice used to treat plants. Homeopathic medicines can be used in agriculture from seed germination to crop production for various purposes. Most of the preliminary work started with observing the effect of homeopathic drugs on seed germination of different crop species. From late 20th century, scientific studies are performed rapidly in laboratories. The study of Agrohomeopathy is not limited only up to seed germination. Eradication of biotic and abiotic stresses was also made possible by the practice of homeopathy in agriculture. In 1986, V.D Kaviraj first used Belladonna(Kaviraj, 2011) successfully to treat a diseased apple tree. Here he opened a new door to agricultural research. He preferred lower potencies of drugs, where as recent studies showed that some homeopathic drugs having higher potencies also seems to be very effective on seed germination and stress resistance.The rate of seed germination can be increased under salt stressed condition by the use of Natrum muriaticum200C(Mondal *et.al.,*2012) and Sepia200C(Sukul *et.al.,*2012). Lensi*et et al*., (2010) reported that Nactrummuriaticum6CH have higher capability to increase the growth rate of common beanas compared to Nactrummuriaticum30CH.There are several other applications of homeopathic drug in soil quality improvement, commercially important secondary metabolite production etc. Homeopathic drugsArsenicum album and Sulphur can increase essential oil content in mint(Bonato*et.al.,*2009). Andrade *et.al.,*(2006) worked with 18 different drugs on soil microbes where Solumunum was found to effective to increase microbial efficiency and Magnesium carbonicum was responsible for decrease in microbial efficiency.Homeopathic drugs are cost effective as compared to chemical fertilizers and its required in very less amount. For that reason agrohomeopathy can be a good alternative to traditional agriculture and pest control methods in India. Agrohomeopathy can also be practiced by combining with other biofertilizers. It can reduce the dependency on chemical fertilizers and pesticides.

Selection of Homeopathic drugs:

Initially selection of homeopathic drugs for plants was so difficult because of wide range of drugs and less available literature on Agrohomeopathy. So, initial drug selection to treat plant associated diseases was based on assumptions. Initially researchers tried to find symptom similarities between human and plants before selecting any drug for plants.

But due to progression of Agrohomeopathy research, now it is much easier to select a drug to treat specific plant associated problems. Homeopathic drug selection for abiotic stress resistance (mostly metal toxicity and salt stress) is made simple because numerous research work showed that the Similia Principle has positive application in Agrohomeopathy. Similia Principle states that "Diseases can be cured by something that induces the same symptoms as the disease itself".

Choosing right potency of drug is also very challenging. It was believed earlier that as plant model is much simpler than human model, lower potencies of drugs must be used to treat plants. V.D Kaviraj also preferred lower potencies of drugs in Agrohomeopathy. But recent studies showed that higher potencies of drugs can also perform well and sometimes worked better than its lower potencies. So selection of drug's potency is drug specific and may be some time case specific. There are two forms of homeopathic medicines- liquid and tablets. Both forms of drugs can be used in Agrohomeopathy.

Preparation of Homeopathic Dilutions:

Direct use of homeopathic drugs may lead to negative outcomes in agriculture. Drugs must be diluted with water and mixed properly before application. Drugs can be diluted with water at various ratios- 1:100,1:200,1:500,1:1000,1:5000 etc. it was reported that at higher dilution there is no effect of vehicle(alcohol) remains. So only the effect lead compound of drug can be studied. Sukul *et al*., (2012) reported that at 1:1000 dilution the effect of alcohol was eliminated but the main component of homeopathic drug was active.

Agrohomeopathy in seed germination and development:

Germination of seed is the most important and preliminary step for crop production. *In-vitro* study of agrohomeopathy was also started with observing the effect of homeopathic drugs on seed germination of different crop species. Many researchers across the world found that some homeopathic drugs can increase the rate of seed germination of different plant species. But they functionally vary according to their potency and dilutions. Marques *et al.,*(2012) worked on Sorghum seed germination treated with Arsenicum album and showed that different potencies of homeopathic drugs can influence the rate of seed germination both positively and negatively. Positive effect of drugs on plants can be confirmed by various biochemical assays and statistical analysis. Phosphorus6cH can increase the rate of seed germination of Brassica oleracea (Barbosa *et.al.,*2012). Increased rate of seed germination of radish seeds using Arnica montana9CH was also reported (Donadon, 2011). Along with increased rate of seed germination homeopathic drug can alter protein, sugar, chlorophyll content etc.(Dutta *et.al*, 2013) (Sukul *et.al.,*2014).Seed germination test with different homeopathic treatments was also performed previously under different abiotic stress conditions. These are mentioned latter.

Sanchez(2008) studied the effect of different homeopathic drugs on flowering and fruit in chilli plants of a specific variety. Bonato and de Silva (2003) find out that homeopathic Sulphur can affect the growth and productivity of radish. They found that except Sulphur 200CH (affects negatively), other potencies of Sulphur are helpful for radish cultivation.

Agrohomeopathy to control biotic stresses:

Biotic stresses are mainly associated with plant diseases. There are various causative agents for plant diseases- fungus, bacteria,virus,insects etc. To control these disease causing agents, some researchers used potentised homeopathic drugs successfully. A bunch of mulberry diseases(root knot, leaf spot, powdery mildew, mosaic disease and turka disease) can be cured by Aakashmoni 200CH (Dutta and Dutta,2012) and Cina200CH used to treat root-knot disease only(Dutta,2006).High dilution of Belladonna can affect the mycelial growth of *Corynespor acassiicola* (Fagan,2011). Root knot disease is caused by nematodes, whose severity can be reduced by using potentized Cina in cucumber plants(Sukul *et al.,* 2013) and in Lady's finger plants(Sukul *et al.,*2006). Fungal disease-Rusts can be eliminated using homeopathic solutions Silicea terra 30CH (Bonato *et al.,* 2006). Biotherapic 27CH and 28CH of *Alternaria solani* has the capability to control early blight in tomato plants(de Toledo *et.al.,*2010). Betti *et al.,*(2003) were able to increase TMV resistance in tobacco plants using homeopathic Arsenic.SCMV is causing another plant associated disease, whose infection can be controlled by Lachesis30CH and Isotherapic Virus30CH dynamization (Bonato *et.al.,*2006).

Agrohomeopathy to control abiotic stresses:

Abiotic stresses may of different kinds, i.e.- Salt stress, heat stress, cold stress, drought stress, metal (copper, nickel, lead, cadmium, arsenic etc) toxicity etc. abiotic stresses are caused by various abiotic environmental factors and there are many methods of eradicate these stress conditions. But these methods are either very costlier or inefficient. In most of the cases abiotic stress resistant plants are derived by genetic engineering. Agrohomeopathy is a sophisticated way to resist the plants against abiotic stresses without genetic engineering.

Salt stress (50mM NaCl) tolerance of Cowpea seeds by the treatment of Sepia200CH was reported by Sukul *et al.,*(2012). In the same year Mondal *et al.,*(2012) successfully germinated cowpea seeds under 100mM salt stress using Natrum Meriaticum200CH as a homeopathic remedy. To overcome metal toxicity, there are several specific homeopathic remedies. Cuprum sulphuricum can combat toxic effect of copper in *Vigna ungiculata* (Banerjee, 2013). Homeopathic preparations Alumina (6CH and 12CH) and Calcarea carbonica6CH and 12CH) can improve the rate of seed germination of lettuce seeds exposed to toxic levels of aluminium(Bonfim *et al.,*2010). Another drug Arsenicum album resulted positive impact on the growth rate of arsenic impaired duckweed (Jager, 2010).

Field trial of various crops using agrohomeopathy:

Field trials are needed to check the quality and productivity of crops in a mass scale. Field trials include seed germination, growth of seedlings and crop production. For healthy growth of plants and higher crop productivity agrohomeopathy is applied successfully. As for example Trebbi *et al.,*(2012) performed field trial of strawberry plants using various homeopathic medicines. Mondal *et al.,*(2013) reported that potentised (2-choloroethyl trimethyl ammonium chloride (CCC) could promote growth and yield of rice plants during field trials.

Discussion:

Homeopathy is a path of medical sciences which can cure human ailments very efficiently. But in late 20th century V.D. Kavirajopened a new dimension in agricultural sciences using homeopathy. Before his publications, there was very little idea about the effect of homeopathic drugs on plant model. But Kaviraj focused on Agrohomeopathy and made it attractive to the scientific community for research purposes. According to him treatment of plant is similar to the treatment of animals.

Future of agrohomeopathy depends on success rate of agrohomeopathy research and field trials. Agrohomeopathy may be a good choice in every aspect of agriculture. For proper application of homeopathic drugs in agriculture, higher quality research must be carried out and proper database in needed to be setup. In-vitro study of agrohomeopathy is needed for proper assessment of drug effect. As for example- *In-vitro* growth of *Avena sativa* using various homeopathic dilutions of acetone(Reis *et al.,*2011). There are many successful research works on agrohomeopathy but in-vitro study is very less in number.More numbers of field trials are also required in our country to check the efficacy of drugs in large scale of agricultural land and crop varieties.Betti*et.al.,*(2009) mentioned the requirement of more field trials in a review article.In case of studying the effect of homeopathic drugs on seed germination, scientists are able to identify many drugs which can improve the rate of seed germination. Eradication of various stress conditions were also made possible by agrohomeopathy. Dutta and Dutta (2012) mentionedthe ways of controlling mulberry diseases using homeopathy. Before starting research on agrohomeopathy researchers have to understand basics of homeopathy medicines. It was seen that eradication of abiotic stresses by homeopathic drugs support the 'Similia principle' stated by Dr. Samuel Hahnemann in his book Organon of Medicine (1993).But there is a conflict between preliminary researchers and new researchers due to the selection of specific potency of homeopathic drugs. Primarily it was believed that lower drug potency is good for plants but now a days there are some scientific reports show that higher drug potency can function better than lower potentised drugs in some cases.

Conclusion:

Agrohomeopathy is a subject where research may be carried out in different fields of agriculture. Agrohomeopathy has the capacity to address typical problems associated with plants. These problems(delayed seed germination, aging of seeds, lower rate of fertilizer absorption, delayed growth, abscission of flowers, various diseases, numerous types of abiotic stresses etc.) can be cured by using homeopathic drugs. But use of specific drug potency is the matter of conflict between preliminary researchers and new researchers. That matter must be solved by more research works for proper and accurate implementation of homeopathic drugs. For proper assessment of the effect of various drugs, more *in-vitro* studies are required. It is believed that agrohomeopathy can be a good alternative to conventional farming. It is also a kind of organic way of farming. Homeopathic drugs may also be used with chemical fertilizers or with biofertilizers. But stress resistance is the most premium quality of some homeopathic drugs. After all these benefits one should remember that few precautions must be taken. Proper drug selection, proper potency of drug and proper dilution of drug with water- these are the three things which are responsible for the success of agrohomeopathy. Apart from these, government aid and initiatives is also important for agrohomeopathy research in a proper direction.

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