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MODERN TECHNIQUES FOR AGRICULTURE AND LIVESTOCK

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Abstract

Agriculture is a vital source of livelihood that provides food and employment. Modern techniques and innovations have been widely implemented in the agriculture and livestock production for the sustainable production and to increase the yield. Innovation involves chemical fertilizer, advanced crop and livestock breeding as well as continuing development of better chemical pesticides. Though these modern technologies have increased the production but led to global climate change. The purpose of this term paper is to delineate and review all aspects of each modern technique and practice involve in agriculture and livestock with their impact on environment and public health.

Key-words: agriculture, climate change, livestock, pesticide, public health

Introduction:

Agriculture is one of the oldest professions which include cultivating soil, growing crops and raising animals. It has been a major component of U.S. economy. Since the mid-20th century, U.S. agriculture has been changing and number of agriculture lands has been reduced but increased in size. Farmers used to grow crops and rearing animals together (Maxwell, 2008). In addition, agriculture residues had been used as feeder for the domesticated animals. The requirement for efficient food production has never been completed as per population demand. Shortages of food affect all aspect of human life and persist for various reasons including unequal access to land, to sufficient and nutritious food, and to other productive resources. However, world populations are increasing very rapidly therefore, food production needs to increase to address this unequal access to food and resources, and to meet the requirements of a growing world population. Currently, harvesting and rearing of animals are two different approaches. Several modern techniques and practices have been employed to increase the crop yields and animal production. Although, modern techniques has increased the crop productivity but it also has had a number of potentially detrimental environmental and public health issues.

Modern Crop Techniques and Practices

Farmers use techniques and modern practices to make advances in producing more food for a growing world (Maxwell, 2008). Modern agriculture practices are as following.

1. Chemical fertilizers

Fertilizers are widely used in agriculture particularly nitrogen containing fertilizer because nitrogen is the most essential component for the growth of plants. However, intensive application of chemical fertilizers has led to the contamination of ground water with large concentration of nitrate (a form of nitrogen) which is poisonous to human and animals. It ultimately contributes to global climate change.

2. Synthetic chemical pesticides

Pesticides are chemicals used in agriculture to kill pests. Pests include insects, fungus, and rodents that destroy harvests and carry diseases. Pests can destroy the crop during harvesting, transportation and storage. They also cause severe economic losses because pest infestation compromises the characteristics and self-life of commodities. Moreover, pests may provoke the severe damage at the broad range of stored commodities. Therefore, it is highly important to control pest populations using chemical pesticides. Pesticides can be classified into three categorized namely;

1. Insecticides

Insecticides are chemically synthesized compound used against insects and spiders. Insect infestation decreases the nutritional quality of foods. In addition, insect facilitates the growth and colonization of invasive species of fungus and subsequent production of aflatoxin within foods. Consumption of aflatoxin contaminated foods can cause a range of serious food safety issues. Several chemical insecticide labels have either been eliminated or are under review because they leave harmful residues in food or in the environment, or insects have developed resistance to them. Insecticides like DDT might remain active in the environment for several years and contaminate wild life, crops and ground water. The most often use fumigant, methyl bromide (MB) class I controlled substance) that has a long history of use in agriculture has been scheduled to end in developed countries by 2005 and worldwide by 2020 under the Montreal Protocol because of its ozone depleting property (Protocol, 1987). Additionally, methyl bromide is reported as a potent neurotoxin and carcinogen (Budnik et al., 2012). Organophosphates (OP) insecticides, among which are some residual insecticides (chlorpyrifos methyl, chlorpyrifos ethyl and malathion) commonly used by the food industry are called for re-evaluation.

ii) Herbicides or Weedicides

Unwanted vegetation is removed by spraying the selective herbicides. Selective herbicide does not affect non-target crop species only kill targets such as larger plants, trees, and bushes. In contrast, non-selective herbicides kill all types of plant species and can be used in lawn. However, if herbicides are used in large amount or spraying when the crop species is very sensitive to herbicide, the quality as well quantity of crops might be affected

resulting in decrease the economic value of damaged crops. Herbicides can also affect human populations through changes in the nature of their habitat.

iii) Rodenticides

Rodenticides attract and kill the rodents such as rats, mice, and squirrels while consuming the bait. Rodenticides can also have adverse effects on environment and human by damaging crops and, transmitting diseases. Exposure of rodenticides poses to human health risk such as skin irritation.

3. Integrated pest management approach

Integrated Pest Management (IPM) is a strategy to prevent and suppress pests with minimum impact on human health, the environment and non-target organisms. IPM is based on economically and environmentally effective pest control method. This systematic approach also promotes improved decision making to reduce losses of crops. The emphasis on IPM is also important because of limited inventory of active and environmentally compatible pesticides. This includes the use of natural enemy, resistance plant varieties, bio agent, plant products and physical control methods such as heating, cooling and sanitation.

4. Genetic modification and breeding

Biotechnology is a novel approach to address problems of agriculture production. Crop plants might be genetically modified through selective breeding to improve the yields, and increase the nutritional value of crops. The basic approach is first to isolate a gene of interest that code a desired characteristic and incorporate with into the DNA of interest species. Biotic (pests and diseases) and abiotic stresses (drought, salinity, and cold) resistant plant varieties might also be developed using genetic engineering strategies. For example, transgenic Bt corn hybrid that was engineered to protect against pests. However, two distinct public health concerns are associated with the cultivation and consumption of genetically modified foods (GMFs). GMFs may produce allergens that cause allergic reactions in susceptible people. The safety of GMFs is very challenging because of limiting the spread of hereditary materials in surrounding environment is very difficult. Another concern is antibiotic resistant gene of genetically modified plants that might somehow be transferred in the bacteria present in soil or in human and animal guts.

Modern Livestock Production Practices

Meat is an important source of protein and also important nutrients and other components. In addition, a small portion of meat contains enough energy for activity. Livestock is a very important component of agriculture that accounts around 40% of worldwide income (FAO, 2018). From last three decades, the demand of animal products including meat, milk and egg has been increased. Livestock is the largest user of land resources for grazing animals on lands. Currently, the growing of crops with fossil fuels has been subsidized in livestock production.

There are the key elements of modern livestock production

1. Concentrated animal feeding operations (CAFOs)
2. Slaughter and meat processing

3. Animal carcasses
4. Dairy farming

1. Concentrated animal feeding operations (CAFOs)

It is estimated that around 34.4 million cattle, 110 million hogs, and 8.6 billion chickens had been slaughtered for meat in the U. S. in 2010 (Maxwell, 2008). It had been reported that some of these animals were raised in confined spaces such as cattle in outdoor pens and hogs and hens in enclosed housing. Adverse health effects have been found in CAFO workers and CAFO neighbors by regularly exposing to ammonia. CAFOs also contribute to the growth of antibiotic resistant bacteria, which have the potential to harm populations nationwide.

2. Slaughter and meat processing

Workers who process meat or poultry face an array of workplace hazards, with injury, illness and sometimes death. Lacerations from knives are common injury in slaughterhouse. Sometimes workers suffer repetitive strain injury that cause from repeating same work over and over. Moreover, respiratory problems, and hearing loss are also more common in slaughter and meat processing workers than private industry workers. Workers are also more susceptible to zoonotic diseases that transmit from infected animals to humans and cause fatal illness. Fecal matters of animals have devastating effects on human health. Contamination of Salmonella and Campylobacter spp. is spread through fecal matter of the infected animals (Maxwell, 2008).

3. Animal carcasses

Every year around 34 million cattle are slaughtered for meat and chicken in the U.S. that leave large amount of carcass to be rendered. If carcass does not dispose properly and ignore the unhygienic conditions then several health issue and environmental problems might be caused. Carcass can be contaminated by pathogenic microorganisms including pseudomonads and Micrococcus and Staphylococcus spp., Brochothrix thermosphacta, as well as yeasts and molds (Koutsoumanis and Sofos, 2004). In addition, Creutzfeldt-Jakob disease (CJD), a rare neurological disorder cause in humans due to consumption of prion contaminated meat. Prion is an infectious protein that causes neurodegenerative brain diseases or transmissible spongiform encephalopathy and prion reaches to animals when animal feed is amplified with it.

4. Dairy farming

Milk and Dairy products are excellent source of nutrients for human health such as proteins, fats, minerals. Production of dairy products is being consolidated into larger operations in the U.S. Large dairy operation produces large quantity of milk and milk products as well as large quantity of manure that impact human and environment. Synthetic hormones (bovine somatotropin) are used to increase the milk production in cows and other beef cattle. It is injected to animals every 2 to 4 weeks to produce milk more efficiently. But regular injection of synthetic hormones may cause udder infections in cattle (Maxwell, 2008).

Regulations of food and activities

The regulation of food, agriculture and livestock production in U.S. is governed by several agencies. For the meat inspection, the federal Meat Inspection Act was passed in 1906 but in 1967 it is amended as the Wholesome Meat Act. In 1957, the Poultry Inspection Act was passed. The Federal Food, Drug, and Cosmetic Act (FFDCA) is passed for the inspection of food, and drug. The Federal Insecticides, Fungicides and Rodenticides Act (FIFRA) and Food Quality Protection Act (FQPA) were passed in 1972 and 1996, respectively for food regulation. In addition, Environmental Protection Agency (EPA) sets pesticide tolerance level to protect environment and human. Plant pests and genetically modified crops are evaluated by The United State Development Agency (USDA) before commercialization (Maxwell, 2008).

Conclusions

The ultimate goal of food production is to increase the net benefits for society that comes from agriculture and livestock production services. It is highly important to focus on the use of ecologically based pest management practices to reduce the adverse effects of chemical pesticides on human, beneficial organism and environment. It is also necessary to follow the judicious rules those are set for the use of pesticides and antibiotics in agriculture and livestock production practices.

References

1. Budnik, L. T., Kloth, S., Velasco-Garrido, M., and Baur, X. (2012). Prostate cancer and toxicity from critical use exemptions of methyl bromide: environmental protection helps protect against human health risks. *Environmental Health*, 11(1), 5.
2. Food and Agriculture Organization (FAO). (2018). Animal production. Retrieved on 30 October 2018. <http://www.fao.org/animal-production/en/>
3. Koutsoumanis, K., and Sofos, J. N. (2004). Microbial contamination of carcasses and cuts. *Encyclopedia of meat sciences*, 727-737.
4. Maxwell, N. I. (2008). Understanding environmental health: How we live in the world. *History*, 13(4), 651-658.
5. Protocol, M. (1987). Montreal protocol on substances that deplete the ozone layer. Washington, DC: US Government Printing Office, 26, 128-136.