Chapter 78
Prevalence of Musculoskeletal Disorders of Odisha Farmers in Selected Agricultural Tasks: A Critical Analysis During Seeding, Fertilizing, and Weeding of Crops

Debesh Mishra
https://orcid.org/0000-0003-2665-1365
KIIT University (Deemed), India

Suchismita Satapathy
KIIT University (Deemed), India

ABSTRACT

In the chapter, there are dual main contributions. In the first phase, based on the extensive review of literature on the application of cuckoo search (CS) methodology, its application for the optimization of agricultural pesticide sprayers for maximum efficiency was suggested. In the second phase of study, 75 farmers of Odisha in India were considered to assess their musculoskeletal disorders (MSDs) during seeding, fertilizing, and weeding of crops using a Standardized Nordic Questionnaire with a five point rating scale (i.e., 1 = Very less, 2 =Less, 3 = Nil, 4 = Strong, 5 = Very Strong). Factor analysis was performed for "seeding, fertilizing, and weeding characteristics," "economical characteristics," and "tools and equipment characteristics of farmers." Then Pearson correlation coefficient matrix was generated for the seeding, fertilizing, and weeding characteristics of farmers, followed by regression analysis for the economic characteristics of farmers.

DOI: 10.4018/978-1-6684-2405-6.ch078

INTRODUCTION

Agriculture has been considered as the source of livelihood for most of the Indian families. Its contribution is about 18% of the gross domestic product in India (Department of Agriculture, Cooperation & Statistics, 2014). Similarly agricultural sectors in India also largely contribute to 49% of the total labor force. Most of the Indian spends more than half of their income in food-preservation & security (NSSO, 2013). However, the growth rate of the agricultural sectors in India has been fluctuating and it depends primarily on the rainfall, as most of the cultivating area in India depends on rainfall (Dev, 2013). Farming is also greatly influenced by the techniques and tools used in various stages and activities involved. Though with the development of machinery and equipments, the farming process has become easier, more efficient and productive; still most of the farming activities are carried out by the conventional tools and techniques.

As most of the engineering problems are solved by optimization techniques where the goal is to determine either a maximum or a minimum value of the problem being solved generally known as the objective function. However, for solving the global optimization problems, the Cuckoo Search (CS) method is considered as the most powerful nature-inspired algorithm. It is inspired by the breeding behavior of some cuckoo species, and because of the simplicity & more performing efficiency, the Cuckoo Search method has been applied to various optimization problems in the engineering problems including the agricultural sectors.

Cuckoo Search Method

Cuckoo search is a meta-heuristic algorithm inspired by the bird Cuckoo; these are the "Brood parasites" birds. It never builds its own nest and lays their eggs in the nest of another host bird nest. Cuckoo is a best-known brood parasite. Some host birds can engage directly with the intruding cuckoo. If the host bird identifies the eggs that are not their egg then it will either throw that eggs away from its nest or simply rid its nest and build a new nest. Each egg in a nest represents a solution, and a cuckoo egg represents a new solution. The aim is to use the new and potentially better solutions (cuckoos) to replace a not-so-good solution in the nests. In the simplest form each nest has one egg of cuckoo, in which each nest will have multiple eggs representing a set of solutions.

CS is based on following idealized rules (Yang & Deb, 2009)

1. Each cuckoo lays one egg at a time, and dumps its egg in a randomly chosen nest;
2. The best nests with high quality of eggs will carry over to the next generation;
3. The number of available host's nests is fixed, and the egg laid by a cuckoo is discovered by the host bird with a probability P Є (0, 1). Discovering operates on some set of worst nests, and discovered solutions dumped from farther calculations.
4. Levy Flight is used when new solution is derived from the old one to attain realistic approach.

Based on these rules, the possibility is the host bird can either throw the egg away or abandon the nest, and build a completely new nest. For simplicity, this last assumption can be approximated by the fraction P_a of the n nest is replaced by new nests (with new random solutions). An important issue of Cuckoo Search is the applications of Levy flights for generating new solutions, $X_{(t+1)}$ which is given by equation (1):