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Assessment of working environment of combine harvester operator on Indian farms

Utpal Ekka and Adarsh Kumar

ICAR- IARI, India

Agricultural machine operations are interaction with soil and biological material, resulting in high concentration of dust and particulate matter. The working conditions become worst with high temperature and low relative humidity especially in peak summer in northern India during wheat harvesting season. Exposure to particulate matters not only hampers the work performance but also affects the operators' health. A study was conducted to assess the quantum of particulate matter in the work space of combine harvester. Mass concentration of dust generated during wheat harvesting was assessed based on the size of particle distributed over a large range. Dust concentrator were 37 and 8 times (annual basis) and 62 and11 times (24 hours) higher than the threshold value of PM^{10} and $PM^{2.5}$ respectively (NAAQS). Inhalable, thoracic and reparable particulates matters were observed as 9.5, 4.2 and 1.5 mg/ m^3 respectively. Mean concentration of $PM_{2.5}$, PM_1 and alveoli particles were 0.45, 0.12 and 0.94 mg/m^3. Along with the dust, straw/chaff was generated during the combine harvesting of wheat. Chaff around operator was also measured in terms of size and numbers of particles per unit surface area exposed. In the study chaff samples were collected at six different locations of work space of combine harvester showed presence of wide range of straw sizes. The equivalent diameter of straw collected on the sticky paper on the chest of operator, tool box, gear box, left header, right header, seat back confer large variations of chaff size as 10.6-1325, 11-1370, 10.5-1818, 10.7-1312, 10.2-936.4 and 10.8-1312 micron respectively. Number of particle per unit surface area was 12.4, 10.3, 9.6, 10, 12.1 and 8.8 per mm^2. The dust concentration of inhalable, thoracic and repairable exceeds the permissible limits manifold which can adversely affect the operator health in long term exposure. The straw concentration was also very high which results in irritation of skin and eyes along with swelling of face.

uekka818@gmail.com