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Development and performance evaluation of an iron plough for secondary tillage in vegetable cultivations

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ABSTRACT : A study on the draft ability of small sized Mottu (non-descript breed of bullocks of tribal districts of Odisha) bullocks (Pair weight-450 kg) in operating iron plough for secondary tillage was conducted in the central farm of Orissa University of Agriculture and Technology (OUAT), Bhubaneswar, Odisha in the winter season during the year 2009. The physiological response like pulse rate was observed to be increased with duration but the increase was sharp in the first hour and thereafter the increase was gradual. The pulse rate increased to 25.92 per cent from its initial value after 1st hour of work. Similar trend was also observed in case of respiration rate. The average draft was found to be 468 N which was equivalent to 10.60 per cent of pair weight. The mean clod diameter of 46 mm indicated the good quality of harrowing in terms of pulverization of soil compared to MB plough. The draft requirement was observed to be within the draftability of the small bullocks and bullocks could sustain the load (10.60 % of their body weight) for four hours of continuous working during winter period. The field capacity was observed to be 0.044 ha/h (22.72 hours/ha) compared to 0.047 ha/h (21.27 hour/ha) in four disc harrow. Similarly, the cost of working for secondary tillage with iron plough was least compared to MB plough and four disc harrow, but the time of harrowing was slightly more in OUAT iron plough than the four disc harrow. Considering draftability, fatigue score, field capacity, soil pulverization and cost of operation, iron plough of 300 mm width was found to be suitable for small size bullocks of tribal districts and small and marginal farmers of Odisha.

KEY WORDS : Draftability, Non-descript bullock, Physiological responses of bullock, Fatigue score, Iron plough, Four-disc harrow

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Secondary tillage operation is equally important as primary tillage operation for pulverization of soil to create appropriate soil tilth for effective performance of sowing equipments with regard to proper placement of seeds and their germination (Liu and Kushwaha, 2006). Disc harrow is one of the most prevailing secondary tillage implements used in the Indian farms (Godwin and Dogherty 2006). Harrowing is useful for removing weeds and grasses, breaking clods, loosening soil, uprooting stubbles etc. (Yadav *et al.*, 2006). In Odisha, the tillage operation (both primary and secondary) is generally done by bullock drawn wooden plough or MB plough. But majority of the farmers still uses wooden plough for both the operations due to its low cost and easy availability from the local blacksmiths and carpenters. After secondary tillage operation, they use wooden leveler for leveling the field. A very few farmers use commercially available bullock drawn 6-disc harrows which are found to be beyond the draftability of the local bullocks resulting in less field capacity and poor quality of work. The bullocks of the state are mostly of small and medium category. The bodyweight of a pair of small bullocks varies from 350 to 500 kg whereas in case of medium bullocks the pair weight ranges from 501 to 700 kg (Anonymous, 2010). It is very often found that the bullock drawn implements which are available commercially need a draft above the draught capacity of the local bullocks resulting in the outright rejection of those implements by the