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DEPARTMENT OF AGRICULTURAL ENGINEERING

COURSE CODE & NAME: 19AGO301 & FARM MECHANISATION

III YEAR / VI SEMESTER

UNIT : I **SCOPE OF MECHANISATION IN INDIA**

TOPIC : 5 – Field capacity, efficiency, economics of machinery

Terms related to Field performance of Machines

A) Theoretical Field Capacity: It is the rate of field coverage of an implement that would be obtained if the machine were performing its function 100% of the time at the rated forward speed and always covered 100% of its width.

WxS/10

B) Theoretical Time per ha.: It is the time that would be required at the theoretical field capacity.

C) Effective Field Capacity: It is the actual average rate of coverage by the machine. It is expressed as ha/hr.

C=WxS/10xEf

C= Effective Field Capacity, ha/hr (Acre/hr)
W=Rated width of implement, m (feet)
S=Speed of travel, Km/hr (miles/hr)
Ef=Field Efficiency, %

Thus Effective field capacities on the basis of total minutes per ha., is the sum of the theoretical time per hectare plus the time per hectare required for turns plus the time per hectare required for 'support functions' i.e. time lost as a result of;

i) Adjusting or lubricating the machine
ii) Breakdowns
iii) Clogging
iv) Turning at ends
v) Adding seed or fertilizer
vi) Unloading of harvested products
vii) Waiting for crop transport equipment etc.

Effective or actual capacities will be less than their theoretical or potential capacities.

D) Effective OperatingTime: It is the time during which the machine is actually performing its intended functions.

E) Field Efficiency: It is the ratio of effective field capacity to theoretical field capacity, in %. It includes the effect of time lost in the field and failure to utilize the full width of the machine.

F) Performance Efficiency: It is the measure of functional effectiveness of a machine e.g.the % recovery of usable product by a harvesting machine.

G) Field Machine Index: It is the percentage ratio of effective operating time plus turning time.

H) Comparative Index: It is determined by actual time studies with same machine for different fields.

I) Time Efficiency: It is the ratio of time a machine is effectively operating to the time a machine is committed to operation. Following list describes the time elements that should be included when computing the capacities or cost of machine:

1) Machine preparation time at the farmstead.
2) Travel time to and from the field
3) Machine preparation time in the field both before and after operations (includes daily servicing, preparation for towing)
4) Theoretical field time (time the machine is operating in the crop at an optimum forward speed and performing over its full width of action).
5) Turning time and time crossing grass waterways (machine mechanisms are operating).
6) Time to load or unload the machine if not done on-the-go.
7) Machine adjustment time if not done on-the-go (includes unplugging).
8) Maintenance time (refueling, lubrication, chain tightening etc., if not done on-the-go, not include daily services).
9) Repair time (time spent in the field to replace or renew parts that have becoming inoperative.

J) Factors affecting field efficiency:

1) Theoretical field capacity of machine: Field efficiency decreases with increase in TFC (increasing the width of a 4-row implement by 50% will increase the effective field capacities by 35% for com planter and 40% for cultivator) and with increase in operating speed of the implement.

2) Machine Maneuverability: Farm machines need to be easily maneuvered in fields and on the roads to the fields. Field machines need to be designed to make short turns at ends of the fields and while following crop rows planted on the contour and in curves.

Field tillage or seeding machines can make square turns, Raking or windrowing or bailing operations usually follow a rounded corner pattern.

3) Field patterns: Objectives are:

i) Amount of field travel should be minimum.

ii) Number of non-working turns should be minimum.

iii) Number of non-working travel in interior of field should be minimum.

iv) Field patterns should produce level surface to eliminate water ponding.

v) Repeated machine travel over a particular area of field will cause compaction of soil.

4) Field Shape: An irregular field has less field efficiency than rectangular fields because of excessive turning time.

5) Field Size: Field efficiency of large fields is less.

6) Yield (If harvesting operation): If yield is high it changes the width of cut of machine. Throughout capacity of combine approx is 10tan/hr (4m cutter-bar). 50% of St. crop (40% load).

7) Crop and Soil conditions: If crop and soil conditions are poor machine forward speed reduced, field efficiency will improve, but this is not the desirable factor.

8) System Limitations: Field efficiency may be limited by capacity of other operations in a system, e.g. seedbed preparation and planting is a system in which seeding is required immediately after the soil preparation. Seeding can be done 1 acre/h but seed bed preparation can't (disc narrow one vass acres/h.

A. Mechanisation Terminology:

- Selective mechanization : Use of machines or equipment for selected operations only.
- Low-cost mechanization (cheap & affordable)

Tools, gadgets and equipment which cost less and can be fabricated by village artisans and small scale industries.

1.Tool : It is a simple mechanical or electro-mechanical device to perform a task. An individual working element of a machine such as disc, shovel, cutting blade is also known as a tool.

2.Implement : It is an equipment with no moving or driven parts, such as a plough, cultivator harrow, i.e., it consists of a rigid structure with working tools.

3.Machine : It is a combination of rigid bodies with linkages executing specified motions and performing desired tasks.

4.Equipment :It is a general term used for any tool, implement, machine or gadget.

5.Device :Any mechanical contrivance which offers mechanical advantage.

6.Gadget :A small and relatively simple tool or machine is called a gadget.

B. Types of Implements:

1. Pull-type or trailed implement :

It is pulled and guided from a single hitch point and is not completely supported by the tractor.

2. Mounted Implement :

It is hitched to the tractor through a three-point linkage in such a manner that it is completely supported by the tractor when in the raised position. The linkages p0rovide a rotational stability about the longitudinal axis and permit depth or height control by the vertical support from the tractor

3. Semi-Mounted Implements

It is attached to the tractor through a horizontal or nearly horizontal hinge axis and is partially supported by the tractor at least during transport, but it is never completely supported by the tractor. In heavy and large semi-mounted implements supports wheels at the rear or in the middle together with remote hydraulic cylinder are utilized for raising and lowering the complete implement/machine or its individual units.

4. Self-propelled machine.

One in which propelling power unit is an integral part of the implement/machine.

Advantages of Mounted Equipment:

1.Mounted equipment are less expensive than equivalent pull-type equipment.
2.Support wheels and accompanying structure required on pull type equipment is eliminated.
3.Single depth or height control system forming a part of the tractor.
- Maneuverability is better
- Visibility is better
- Transport is easier
- Draft-sensing advantage
- Vertical load transfer to aid in traction
- Attaching & detaching is easier

Standardisation of Three-point hitch and “Quick-attaching couplers” to permit interchangeable use of different makes of equipment.

Limitations of Mounted Implement:

1.Carrying capacity of tractor chassis
2.Transport stability is a limitation

Advantages of Self-propelled machine:

- Greater flexibility
- Better maneuverability
- Better visibility
- Better control by operator
- Improved mobility
- Reduced losses when cutting unit is in front of the unit.

Disadvantages:

- Greater initial investment. It must have higher annual use to be economically competitive with a pull-type machine.

Thank You