inputs and, therefore, greater economic and environmental benefit in comparison with uniform management.

14. Precision livestock farming (PLF):-

Precision livestock farming (PLF) is defined as the management of livestock production using the principles and technology from precision agriculture. Processes suitable for the precision livestock farming approach include animal growth, milk and egg production, detection and monitoring of diseases and aspects related to animal behaviour and the physical environment such as the thermal micro-environment and emissions of gaseous pollutants. Systems include milk monitoring to check fat and microbial levels, helping to indicate potential infections, as well as new robotic feeding systems, weighing systems, robotic cleaners, feed pushers and other aids for the stockman such as imaging systems to avoid direct contact with animals. New systems for data monitoring for feed and water consumption can be used to the early detection of infections is available now. Other developments include the monitoring on the growing herd where measurement of growth in real time is important to provide producers with feed conversion and growth rates.

15. On-line resources for precision agriculture :-

There is a wealth of information available over the internet on new technology for farm production. Most

manufacturers of farm equipment, GPS receivers, sensors, and other PA technologies use this media to inform growers on new products, technical specifications, trouble-shooting information, software upgrades, and a variety of services.

16. Remote Sensors:-

These are generally categories of aerial or satellite sensors. They can indicate variations in the colours of the field that corresponds to changes in soil type, crop development, field boundaries, roads, water, etc. Arial and satellite

imagery can be processed to provide vegetative indices, which reflect the health of the plant.

ADVANTAGES OF PRECISION FARMING (PF)/PRECISION AGRICULTURE (PA):-

1. Precision agriculture can contribute to reduced waste,
2. It help to increase total profit from agriculture
3. Help to protect the environment by precise application of inputs.
4. Precision agriculture can provide both environmental and economic benefits as consequences from reduced or targeted placement of crop inputs that include water, pesticides, and nutrients.

- **Precise nutrient applications** can give important environmental and economic benefits. The aim is to apply only the nutrients that the plants require and can use. Rates of application will differ within the field based on the type of soils, levels of fertility, and sensitivity to the environment. There is some type of soils in a field that does not have the potential to validate maximum rates of nutrient application. On the other hand, there might be areas that need to be reduced rates because of sensitivity to the environment.
- **Precise pesticide applications** can offer both economic and environmental benefits. One of the cheapest and fastest environmental payoffs for applications of pesticides is the use of light bar guidance systems. These affordable light bar guidance systems offer an easy method to lead equipment across a field to prevent overlapping when pesticides are being sprayed.
- **Precision Soil preparation :- Soil preparation** is the first step before gro,ving a crop. The ultimate objective is to produce a firm and weed-free seedbed for rapid germination and emergence of the crop. One of the most important tasks in soil preparation is tilling (or ploughing): turning the soil and loosening it.

Precision Seeding :-

- **Seeding (or: sowing)** is a critical step in crop growing. For a successful seeding process, two challenges need to be overcome:
- **Correct depth:** if sown too deep into the soil, roots will not be able to breath. If sown on the surface, birds may damage the seeds.
- **Proper distance:** if plants are overcrowded, they will not to get enough water, nutrients and sunlight, resulting in yield loss. If they are planted too far from each other, valuable land is left unused.

Precision Crop Management :-

During their growth phase plants need:

- The right amount of nutrients - **FERTILISATION**
- Adequate protection from pests and diseases - **CROP PROTECTION / SPRAYING**
- The right amounts of water - **IRRIGATION**
- In all three areas, precision farming solutions help farmers to **produce more with less.**

Precision Harvesting :-

- For the farmer, **harvesting** is a critical point in time. Speed, accuracy, and timing determine whether the harvest will be successful. Until recently, harvesting was the most burdensome and laborious activity of the entire growing season. Today, the task is taken over by some of the most sophisticated farm machines such as:

Precision Livestock Fanning :-

- **Livestock farming is facing tremendous challenges today:**
- **Increasing production:** over the next 15 years, global demand for meat is expected to increase by 400/o triggered by a growing number of people adopting protein-richer diets. According to the UN's Food and Agriculture Organisation (FAO), technology solutions in agricultural and livestock production systems will play a key role to address this challenge and ensure an adequate food supply for an expected population of 9.7 billion by 2050
- **Promoting sustainability & animal welfare:** while increasing production, it will be important to find ways to minimize the environmental footprint of livestock farming and ensure high levels of welfare and health for animals.
- **Alleviating farmers' workload and ensuring economic viability of farm operations:** it will be important find solutions that will enable farmers to manage large number of animals in an adequate and profitable manner.

Precision Livestock Farming (PLF) systems:-

PLF systems:

- help farmers to increase livestock production and quality of production in a sustainable manner
- offer tailored care for the animals in terms offeeding, milking and housing
- make many of the farmer's daily tasks much easier to handle

H

Examples of PLF systems include:

Precision feeding systems: feeding systems allow farmers to feed their cows accurately, precisely and with minimal expenditure of work at all times (24/7).

Precision milking robot: a good example of large adoption of PLF systems are automatic milking machines. These robotic systems can handle up to 65 cows on an average of 2.7 times per day.

Stable and farm management systems: various PLF support and monitoring systems exist, which use cameras and microphones and thus act as theeyes and ears of the farmer at all times.

Benefits of PLF systems:

a. **Greater sustainability & higher productivity:** recent studies show PLF management systems can raise milk yields, while also increasing cows' life expectancy and reducing their methane emissions by up to 30%.
b. **Increased animal welfare through an individual 'per animal' approach:** PLF systems allow farmers to follow and manage the individual animal's status and well-being closely at all times. They can detect diseases at an early stage, for instance, acoustic sensors can pick up an increase in coughing of pigs. PLF systems can also alert farmers of specific needs of animals by sending an SMS.
c. **Easier farm operations:** PLF systems enable livestock farmers to take care of a large number of animals per farm, while providing individual attention to each animal and complying - and documenting compliance - with high quality and welfare standards.

DISADVANTAGES

I. Precision farming cannot be utilized completely in every crop.
2. Precision farming needs the good economic condition of the farmer for adoption
3. It requires technical and skilled persons
4. Initial cost is very high as well as maintenance cost also high
5. For adoption of precision farming farmers must have a technical knowledge.

DIFFERENCE BETWEEN TRADITIONAL FARMING AND PRECISION FARMING

Traditional fanning	Precision fanning
Unit of treatment and organisation: the field that is regarded as a homogenous arable site	Unit of treatment and organisation: arable site that is regarded as different from one point to the other and at ·'field level" as heterogeneous
Nutrient ma.nagement based on average sample taking	Nutrient management based on GPS and point-like sample taking
Average SUIYey on plant deceases and damage and intervention if necessary	Plant protection treatments based on GPS and point-like plant survey
Sowing with same plant number and variety	Plant species and plant variety-specific sowing
Same machine operation practice	Machine-operation adjusted to the arable site
Unified plant stock in space and time	Unified plant stock o.rga.nised into homo11;eneous blocks at arable sites
Few data influencing decision preparation	A lot of data influencing decision or..-naration