**Mulching of Vegetable crops:**

**Mulching**: - Is the process or practice of covering the soil to make more favorable conditions for plant growth, development and efficient crop production. Materials for mulching can be organic or inorganic (plastic sheeting,). Organic mulches like hay, straw, grass clippings, and compost traditionally are used in backyard gardens and smaller gardening operations, while inorganic plastic mulches have been used by commercial growers in large fields. Tomatoes, peppers and eggplants generally respond well to these plastics.

 **Kinds of mulches:-**

**1-Organic Mulches: -** Typical materials for organic mulching are straw, leaves, cut grass, wood chips, peat, cut branches and various types of compost. The addition of organic mulches such as leaves or shredded bark brings almost an immediate positive effect these effects are:

**1-Physical effects:** (infiltration, improved water-holding capacity, soil structure also has a positive effect on aeration).

**2- Chemical effects:** (soil pH, release of small amounts of nutrients, decomposing).

**3- Biological effects:** (temperature regulation for increasing microorganism activity).

 However, if organic mulches are kept to wet disease-causing pests, fungi and other undesired microorganism may develop and affect negatively on the crop production.

**2- Inorganic Mulches (plastic films):-** Plastic films are more widely used as mulch. They help in maintaining higher water content in soil resulted from reduced evaporation, induced infiltration, reduced transpiration from weeds or combination of all these factors. There are different colors of plastic film such as black, blue, red, orange and grey each one is used for specific purpose.

**Advantages of mulching:-**

1-Mulches keep the soil underneath moist longer than bare soil and prevent evaporation.

2-Controls soil erosion by cushioning the impact of raindrops and by slowing runoff.

3 -Can prevent weed growth by shading them out.

4-Helps maintaining warm temperatures even at night.

5-Synthetic mulches play a major role in soil solarization processes.

6-Mulching improves soil structure and aeration

7-Some mulch can improve soil fertility.

**Disadvantages of mulching:-**

1**-**Mulching is labour-intensive

2-Inorganic mulches are costly

3-Too much mulch can create rotting of the root zone

4-Mulch material can introduce new pests and diseases into a field.

5-When plastic mulch starts to break down into non-recyclable bits; it is hard to remove it again

**Plastic mulch application:**

**Installation Considerations**

**1-Soil Preparation: -** The soil must contain adequate moisture for seed germination when the plastic mulch is laid. Temperatures should be at least 10°C, and the soil should be well worked, and free from undecomposed plant.

**2- Fertilization**: It is best to apply fertilizer during soil preparation, before laying the plastic mulch. After the mulch is installed water soluble fertilizer can be injected through a drip irrigation system.

**3**- **Irrigation**: Drip irrigation is recommended for use with plastic mulches. Plastic mulch should not be used without irrigation for some kinds of crop.

**4**- **Planting the Crop:** Vegetable crops can be established in plastic mulch by transplanting or direct seeding. Transplanting can be accomplished by hand or with a mechanical trans planter.

**5-Windbreaks**: Strong winds can damage or tear plastic mulch. Windbreaks can be helpful in wind-prone areas. Trees or shrubs along the windward side can also protect a field from damage.

**Planting Considerations:-**

**1-Mechanical:** For large commercial operations, mechanical trans- planters are used to set plants through plastic. All planters can be adjusted to various spacing and are pulled behind a tractor

**2- Hand:** While more time consuming, hand transplanting is effective and commonly used on smaller operations. When creating holes for planting, it is better to make circular holes instead of cutting slits or an ‘X’ in the plastic. With holes there is less contact between the transplant and the hot plastic.

**Removing Plastic Mulch**

The traditional method of removing plastic mulch was to first loosen the mulch from the “cup” on each side of the bed by passing a cultivator sweep under the cup and then pick up the mulch by hand.

**Solanaceae( nightshade) Family**:-

The **solanaceae** family includes many common garden “vegetables,” although the part of the plant usually eaten is the fruit (the potato is an exception – here the underground tuber is eaten). This group is also referred to as the “**nightshade**” family. Solanaceous crops include tomato, pepper, eggplant, white and red potato, and tomato. This family also contains several plants that are toxic to humans, pets and livestock. The green parts (leaves, sun-scalded potatoes) of solanaceous crops are toxic and should not be eaten.

**1-Irish Potato (*Solanum tuberosum* L.)**

**Family: Solanacea**

**Main stages of growth and development of potatoes: -**

The growth cycle of the potato can be roughly divided into five stages:-

**Stage 1: Sprout development**: Sprout develops from eyes on seed tubers and grows upward to emerge from the soil. Roots begin to develop at the base of emerging sprouts. At this stage the plants depends upon the stored food in the tuber seed for the growth process.

**Stage 2: Vegetative growth**: Leaves and brunched stems develop from aboveground nodes along emerged sprouts. Roots and stolons develop at below-ground nodes. Photosynthesis begins.

**Stage 3: Tuber initiation:** Tubers begin forming on the end of stolons (underground stems), usually before the plant flowers.

**Stage 4: Tuber bulking**: Tuber cells expand begin with the accumulation of water, nutrients, and carbohydrates

**Stage 5: Maturation**: The tubers reach full size. The top of the plant dries out and dies. During maturation, the tuber skin toughens, extending storage life, the ripeness becomes complete and the harvest must be done

**Plant description:** Potato plant **is** an erect, perennial, aromatic herb belong to the solanaceae family, it grows to (50-120) cm tall and it consist of the following parts:

**-Roots:** The roots are numerous, fine, fibrous and adventitious. The depth of the root may reach to about 150 cm and the adventitious roots extended horizontally to about 40-60 cm before it grows down vertically.

**-Stems**: Erect, succulent, winged and branched. It reach to about (30-90) cm tall. Stems are generally green, but sometimes it may be red-brown or purple.

**-Stolons:** Morphologically**,** potato stolons are lateral stems which grow horizontally from buds of the underground part of stem after 7-10 days from the appearance of the aerial stems. Stolons may form tubers by enlargement of their terminal end. Un coveredstolon with soil may develop into a vertical stem with normal foliage.

**-Tubers**: Morphologically, tubers are modified stems and constitute the main storage organs of the potato plant. A tuber has two ends; the heel end is attached to the stolon, the opposite side is called either the apical or distal end. The eyes of potato tuber corresponded to the nodes of stem. The eye buds grow out to form sprouts and anew stem of main stem.

**=Leaves:** Alternate, pinnately compound leaves, made up of three or four pairs of oval leaflets and a terminal leaflet, its length reach to about 15 cm and they are dark green in color.

**Flowers:** Bisexual, White to pink, purple or blue, born in clusters, it is about (2.5) cm in diameter with a five parted corolla and yellow stamens.

**Fruits:** A succulent, spherical, yellow-green to purple berry, up to 4 cm in diameter some lack seeds, but others may contain several hundred seeds.

**Potato varieties:**

 There are many varieties of potato cultivated in the world, the most common varieties are:

 1-**Spunta**: Holland cultivar, early maturity. Tubers of this cultivar are big, cylinder give high yield quantity in spring season.

 2- **Draga**: Rounded tubers with white cortex, give a high yield quantity in spring season .

 3-**Diamant**: Moderate late, big, yellow, oval shaped tubers with strong vegetative growth and high yield quantity in both spring and fall season.

 4- **Nor gold Russet-** Oblong tuber with medium russet skin, medium yielding.

**Reproductive methods:-**

Potato is reproduced vegetatively by small complete tubers or big tubers after cutting them. The weight of the tubers must be about 56g and each donum requires about 450-700 kg of tubers. The succession of potato planting depends mainly on using good tuber seeds.

**The conditions of the good tuber seeds are:**

1-Not be infected by diseases especially the viral ones.

2-Must be sprouted and at the right physiological age.

3-These tuber seeds ought to be got from a documented source and specified with producing the certified seed.

4-Free from mechanical damages, not wrinkled nor weathered.

**Planting methods:-**

The soil should be well prepared by ploughing it and adding (12-15 m3 /D) of Composts and then it divided into rows with the distance of 60-70cm between the rows and 25 cm between the tubers. The seed should be planted into moist, but not overly wet soil at a depth of at least 15 cm. In large farms this process will done by using special machines. Cultivation is important for getting ride from the weeds which are found in the rows, also stripping soil from unplanted side and adding it to the planting plants in the other side of the rows will protect the tubers from being green as they are exposed to the sunlight. Depending on soil tests NPK and other fertilizers are added if it needed in three frequencies; the first one is with cultivation and the second after 21 days and the last one is after month from the second addition. Watering potato plants is very important in the dry season. Since water requirements vary according to the size and growth stage of crops as well as the length of their maturity and time of year .For maximum growth, irrigation scheduling is intended to apply water in the appropriate amount in the right time. Different watering systems are used in potato production such as furrows and sprinkler irrigation

 **-Ripening and Harvesting:-** Irish Potato is harvest after 75 to 140 days from planting. The period however depends on the variety. Irish Potatoes are generally mature when the plant starts to turn yellow. Immature potatoes will often skin and bruise easily. When digging potatoes, if the skin is not set and is easily removed, delay the harvest. Avoid harvesting the potatoes when the soil is wet to avoid potato diseases. To harvest Irish potatoes, cut off stems 2 weeks before harvesting to harden the tubers. Dig them out with a forked hoe. **Quantity of Yields**: range between 12-20 t/ha for the spring crop

and 8 -10 t/ha in the autumn.

**Green sprouting:** Is the process in which the buds of the tubers are induced to start growing before planting them in the field .Sprouting process is done by putting the tubers in caskets in few light layers at a temperature of 15-17 C for 2-3 weeks before planting. This process is done at fall season.

**The advantages of this process(green sprouting) are:**

1-Reducing the percentage of absence in the field

 2-Accelerate the germination of the tubers.

3- Formation of strong root system and increase the root-shoot ratio

**Tuber dormancy:** Potato tubers enter into a period of dormancy after harvesting; the period of dormancy depends very much upon genetic and environmental factors, but is usually at least 8 weeks and can be a problem when planting material is required for continuous cropping. However **dormancy can be broken by:** holding the tubers at 20-30°C for 30-45 days or by treating them with chemicals such as chlorhydrin, potassium or sodium thiocyanate, or gibberellic acid. Naturally-broken dormancy, however, is preferred as it gives a more uniform rate of germination and better growth. Once the period of natural dormancy has ended potatoes will begin to sprout.

**Management of disease and insect pests:**

**Diseases:-**

Many potato diseases are fungal diseases, which flourish under certain temperature and humidity conditions. Other diseases such as viruses may be spread by aphids or other insects or be seed borne.

**Example of viral diseases are:**

**- Potato leaf roll virus1**

 **Management:-** sourcing certified seed from a reliable supplier of clean seed and controlling insects, especially aphids, are the best disease preventation.

**-Examples of fungal diseases are:**

**Early Blight (*Alternaria solani*)-1**

**Management :-**

Early blight can be minimized by maintaining optimum growing conditions, including proper fertilization, irrigation, and management of other pests. Fungicide can be used for controlling the disease.

**Late Blight *(Phytophthora infestans*)-2**

**Management:-** Late blight is controlled by eliminating volunteer potatoes, using proper harvesting and storage practices and applying fungicides such as maneb when necessary.

**Examples of bacterial diseases are:**

**Bacterial Soft Rot and Blackleg**-1

**Management:-**

Use pathogen-free tubers for seed. Warm seed tubers to about 13°C before planting. Provide good drainage and do not over irrigate. All dead material should be removed from the field to reduce carryover to future crops. A good crop rotation cycle should be followed.

**Insect Pests:-**

Colorado Potato Beetle , Potato Leaf hopper, Aphids, Blister beetles -

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**Management:** Using crop rotation cycle, Control weeds in non-crop areas including hedge rows and fallow .Using some insecticides such as Andreen and Novacron.