International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue: 3 Volume No.7 May - June – 2023
DOI:10.46647/ijetms.2023.v07i04.010 ISSN: 2581-4621

Various Weed Control Methods – An Analysis

Jeya Daisy I[1], Arjun M[2] , Dakshin D S[3]
[1]*Assistant Professor, Electronics and Instrumentation Engineering, Kumaraguru College of Technology, Coimbatore, Tamil Nadu*
[2,3]*UG - Electronics and Instrumentation Engineering, Kumaraguru College of Technology, Coimbatore, Tamil Nadu*
Corresponding Author Orcid ID: https://orcid.org/0000-0002-2039-3310, https://orcid.org/0009-0001-7952-8988, https://orcid.org/0009-0000-4218-8759

ABSTRACT
As the world's population continues to grow and food consumption rises, the agricultural industry will have a very difficult time fulfilling future demands. The growth of undesirable plants, or weeds, alongside crops is one of the most important problems in agriculture. Weeds increase agricultural costs and inhibit productivity. It necessitates using more water to irrigate the land. They somehow reduce the value of the food or raise the expense of cleaning. Some weeds (Cleome viscosa), which dairy cows consume, cause the milk to smell bad. Crops and weeds compete for nutrients, space, sunshine, and water. They also harbour viruses and insects that are harmful to agricultural plants. Additionally, they harm local animals and plants by destroying their natural habitats. As a result, these weeds must be removed in a timely manner to ensure the health of the crops. This report discussed some of the weed control approaches.
Keywords— Agriculture, Weed control, Agricultural, Growth

1. Introduction

The agriculture sector will have a difficult time satisfying future expectation due to a growing population and expanding food consumption. Threats to this business include weeds, viruses, bacteria, fungus, and insects. By competing with crops and reducing crop production, biotic organisms frequently diminish productivity. The most significant of these is weeds. Weeds that are related to crops in nature fight with them for everyday tasks including absorbing light, water, nutrients, and other things. They have greater physical and genetic characteristics than crops, which makes them more tolerant. They also operate as a shelter for harmful species like pests and bacteria that spread illness, which harms the crops.

For example, Colletotrichum gloeosporioides f.sp. malvae lives on round leaf mallow (Malva pusilla), and Colletotrichum truncatum lives on Hemp sesbania (Sesbania exaltata). These weeds and bacteria contain a lot of allergens, which can cause serious health problems if eaten. Infestation of these in processed products such as beer and wine lower the quality of the product. Weed competition has resulted in a 37 percent reduction in crop yield in India.

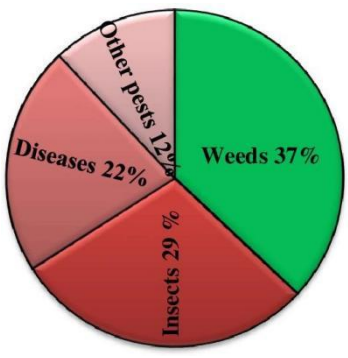

Fig 1. Crop damaging factors.

International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue: 3 Volume No.7 May - June – 2023
DOI:10.46647/ijetms.2023.v07i04.010 ISSN: 2581-4621

Weeds can now be removed by mechanical, cultural, biological, chemical, and technological means. There are mechanical techniques including hand pulling, hand hoeing, tillage, mowing, floods, and more. Among other cultural approaches, crop rotation, fertility management, planting date, and spacing are examples. Herbivores, diseases, insects, and other biological techniques are employed. Chemical approaches include preplant, preemergence, and postemergence. Drones or unarmed vehicles (UAVs) are among the technical techniques used for weedicide application.

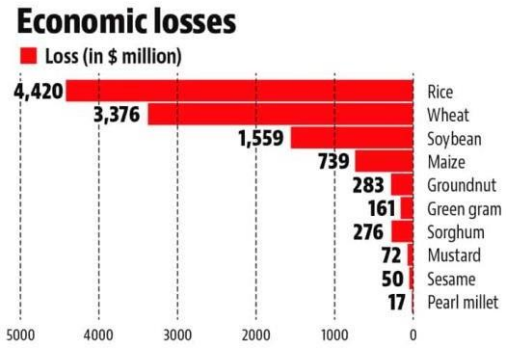

Fig 2. Hindustan Times

In western nations, weed competition affects the production of crops like maize and soy by roughly 50%. Even after investing $25 billion on herbicides and weedicides, it is estimated that weeds still cause a $100 billion yearly economic loss in the world. The Indian government reported that between 2003 and 2014, we lost over $10,000,000,000 in yield. This demonstrates that weeds cost the nation $909 million in lost revenue each year.
In order to address these problems and maximise the potential of the crops, we now use agricultural drones in conjunction with mechanical cutting technologies.

2. Use Case
MANPOWER:
Hiring labourers is the most common method of weed control in rural regions. With around 20 individuals per acre, they often approach the region and remove the weeds one by one in under an hour. Crops are more susceptible to harm when there are more people working in the field. The issue of a labour shortage follows. MGNREGS and the desire to work for a position with a higher salary are a couple of the reasons for their absence. The Mahatma Gandhi National Rural Employment Guarantee Scheme is preferred by most people since it would lead to fewer employment with higher pay. Other people will want a higher wage if they are called in to remove weeds. To remove the weeds from an acre, 15 to 25 workers are needed. This is determined by the number of weeds in the field. The pay demanded by the labors are based on the quality of the work performed by the labors on that particular day, not on a per capita basis.

Fig 3. Labour Wages Report

International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue: 3 Volume No.7 May - June – 2023
DOI:10.46647/ijetms.2023.v07i04.010 ISSN: 2581-4621

WEEDICIDE:

An additional crucial technique for weed management in fields is the use of weedicide. Chemicals that eliminate weeds without hurting crops are called herbicides, commonly referred to as weedicides. But if these weedicides are used excessively, the crops become unsuitable for food. It also threatens other creatures, including helpful microbes like rhizobia, pseudomonas, and earthworms. Regular weedicide use will hurt both food consumers and agricultural land since it is also associated with a loss of soil fertility. The overuse of these substances enriches the earth with nutrients. During rainy seasons, these nutrient-rich soils are washed into water bodies, increasing the amount of nutrients in the water and leading to eutrophication.

WEED CUTTER:

One of the tools that is presently most frequently used to chop weeds is the weed cutter. The weed cutter may be utilized for a variety of additional jobs, including harvesting. There are two versions of this machine. engines with 4 and 2 strokes Here, the machine is being operated by a worker. The worker would approach the field with the trimmer in hand and start physically trimming the weeds. The trimmer consists of a motor, a moving blade, a handle, and a fuel tank. While the 4-stroke engine needs 500 mL of fuel and spins at 7000 rpm, the 2-stroke engine consumes 750 mL of fuel and spins at 10,000 rpm. A 2-stroke engine is therefore more effective than a 4-stroke engine. The motor is fueled by gasoline or diesel, which contributes to pollution. The carbon released using these fuels could endanger crops. The first big drawback is that it is a time-consuming operation. The next disadvantage is that it may be less accurate in weed selection for the trimming process, posing a significant risk of crop damage owing to human mistake. This equipment ranged in price from 20,000 to 35,000 rupees.

Fig 4. Weed Cutter

Over – Cropping:

With this technique, farmers try to completely cover the field with crops, limiting the space available for weeds to thrive. Although it reduces the soil's fertility, this approach of weed control is successful. This method overproduces, which reduces soil fertility. Because there will be less productive crops as a result of regularly using this technique, the field's overall production will decrease. This is due to a lack of space, water, or nutrients for the crops to grow in. This results in higher costs for the field's overall maintenance, labour, and seeding. This approach is rarely used.

Computer vision-based weed control:

One of the most widely used methods now is computer vision-based weeding control. The initial step in this process is weed detection. Gathering the required photographs, pre-processing the images, and finally creating a weed recognition algorithm are all processes in the weed detection process. With the camera, we must take at least 500 pictures. After collecting, the photos must be split into RGB brands according to the terrain, and plant pixels must then be extracted using pre-processing. Both the edge detection technique and the CNN module are frequently used for weeding identification. The sharpening filter is used in the edge detection method to distinguish between plants and weeds depending on how sharp their leaves are. The first step in edge detection is to convert colour photos

International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue: 3 Volume No.7 May - June – 2023
DOI:10.46647/ijetms.2023.v07i04.010 ISSN: 2581-4621

to grayscale pictures. After conversion, the only parts of the crops and weeds that remain visible are their veins and edges. After that, the picture is divided into blocks. The block is considered weedy when the edge frequency exceeds the threshold value. In this way, weeds are detectable. The processes involved in weed detection are shown in the flow chart. Pre-processing steps included colour space transformation, normalisation, and size reduction to produce enhanced images. Vegetation segmentation was then required to produce binary images, which were then classified using a machine learning or deep learning module to produce classifications for weed and crop types. There are several methods for weed eradication after weed detection, including the use of mechanical tools or drones for weed spraying in regions with a lot of weeds. Researchers were developing a tool for removing weeds.

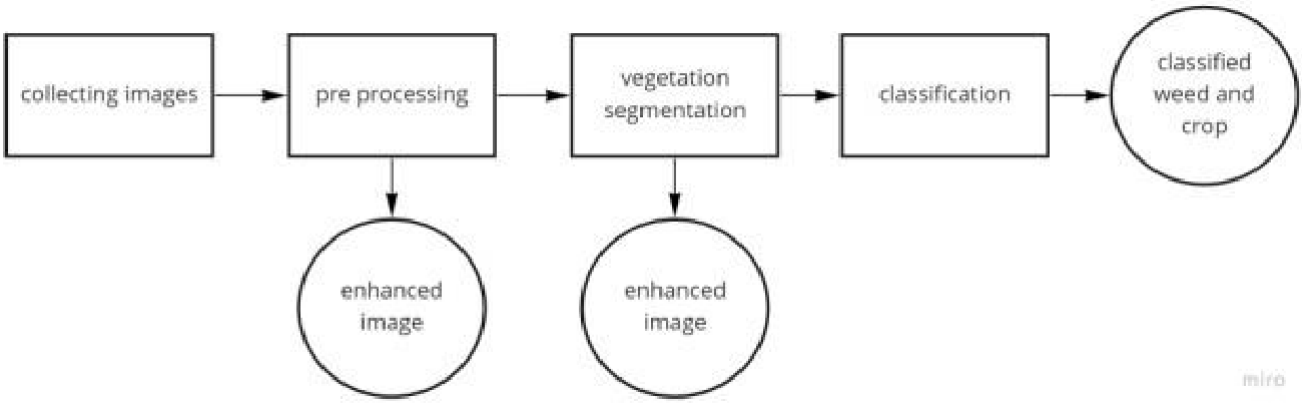

Fig 5. Computer vision-based weed control

Sensor-based mechanical weed control:

Unlike spraying, mechanical weeding involves actual physical contact between the machinery and the soils. Timing, frequency, cultivator type, crop growth range, soil texture, and moisture cultivation types of post emergent weed control whole field treatments, inter row, and intra row treatments are all factors to consider for optimal mechanical weed control. sensors that recognise A navigation system called the global navigation satellite systems (GNSS) uses signals from space satellites to transmit position and time information to GNSS receivers. Various mechanical weed control techniques are also possible with new GNSS planting technology. Multiple-directional hoeing disturbs weed plants in every conceivable way. A second hoeing pass parallel to the first can be used to get rid of any weeds that could have survived the initial pass. The following phase is LiDAR (light detection and ranging). Phase difference between a laser beam's emission and reflection is picked up by LiDAR sensors. LiDAR technologies have also been very successfully utilised to find and categorise weed plants inside an agricultural field. sensor for ultrasonic wave detection Sound waves is used by ultrasonic sensors to calculate the separation between a sensor and a plant. They can also be used to locate areas where weed infestation is out of control in agricultural fields. After weeds were found using sensors, a variety of mechanical weed-removal tools were on the market, and researchers were also engaged in this field.

CONCLUSION

Weed management is one of the most crucial agricultural procedures. The farmer needs to be very skilled to develop a long-term plan to minimise weed burden. as we looked at several weed control methods The majority of people employ the hand-pulling method to remove weeds. Scientists studying herbicides are also creating non-toxic weedicides that won't hurt crops. The only tool on the market that farmers can easily use is a weed cutter, which comes next. The implementation of cutting-

DOI:10.46647/ijetms.2023.v07i04.010 ISSN: 2581-4621

edge weed management strategies like computer vision and sensor-based weed control will follow. Weeds are first identified, and then the area is cleared by certain autonomous equipment. Accurate crop recognition is helpful for site-specific management as well. For site-specific specialised crop management, such as autonomous cauliflower harvesting, accurate crop recognition is especially helpful. Even if there are still challenges to overcome, the future appears promising because many academics are putting their emphasis on the project. Therefore, autonomous robots and drones will rule this sector in the future.

References

1. Pusphavalli, M., & Chandraleka, R. (2016). Automatic Weed Removal System using Machine Vision. International Journal of advanced Research in Electronics andCommunication Engineering (IJARECE), 5(3), 503-506
2. Pramod, R., Sandesh, M. D., Jayaram, M. S., & Kalasagarreddi, K. (2014, December). Design and Development of Sustainable Weed Cutter. In 2014 3rd International Conferenceon Eco-friendly Computing and Communication Systems (pp. 287-292). IEEE.
3. Osepchuk, J. M. (1980). B45 2-Stroke Petrol Grass Cutting Brush Cutter Machine.
4. Mrs. Latha, A Poojith, B V Amarnath Reddy, G Vittal Kumar; "Image Processing In Agriculture"; IJIREEICE; 2014.
5. [5] AnupVibhute, S K Bodhe; "Applications of Image Processing in Agriculture: A survey; International Journal of Computer Applications"; 2012
6. Wu X, Aravecchia S, Lottes P, Stachniss C, Pradalier C. Robotic weed control using automated weed and crop classification. J Field Robotics. 2020;1–19
7. Bechar, A., & Vigneault, C. (2017). Agricultural robots for field operations. Part 2: Operations and systems. Biosystems Engineering, 153, 110–128.
8. Bawden, O., Kulk, J., Russell, R., McCool, C., English, A., Dayoub, F., Lehnert, C., Perez, T., 2017. Robot for weed species plant-specific management. J. Field Robot. 34 (6), 1179– 1199.
9. Haug, S., Michaels, A., Biber, P., Ostermann, J., 2014. Plant classification system for crop/ weed discrimination without segmentation. In: 2014 IEEE Winter Conference on Applications of Computer Vision, WACV, Steamboat Springs, CO, pp. 1142–1149.
10. Utstumo, T., Berge, T., Gravdahl, J., 2015. Non-linear model predictive control for constrained robot navigation in row crops. In: Proceedings of the IEEE International Conference on Industrial Technology, Sevilla, Spain.
11 Hall, J.C.; Eerd, L.L.V.; Miller, S.D.; Owen, M.D.K.; Prather, T.S.; Shaner, D.L.; Singh, M.; Vaughn, K.C.; Weller, S.C. Future Research Directions for Weed Science1. Weed Technol. 2000, 14, 647–658.
12 Tillett, N.; Hague, T.; Grundy, A.; Dedousis, A. Mechanical within-row weed control for transplanted crops using computer vision. Biosyst. Eng. 2008, 99, 171–178
13 Kunz, C.; Weber, J.; Gerhards, R. Benefits of precision farming technologies for mechanical weed control in soybean and sugar beet—Comparison of precision hoeing with conventional mechanical weed control.
14 Shamkuwar, S. V., Baral, S. S., Budhe, V. K., Gupta, P., & Swarnkar, R. (2019). A critical study on weed control techniques. *International Journal of Advances in Agricultural Science and Technology*, *6*(12), 1-22.
15 Nedeljković, D., Knežević, S., Božić, D., & Vrbničanin, S. (2021). Critical Time for Weed Removal in corn as influenced by planting pattern and PRE herbicides. *Agriculture*, *11*(7), 587.