AGRONOMIC PRACTICES ADOPTED BY THE MAIZE (*Zea mays*) FARMERS IN HOROWPATHANA DS DIVISION IN ANURADHAPURA DISTRICT IN SRI LANKA: A CASE STUDY

ABSTRACT

Maize (*Zea mays* L.) is the third most important cereal crop globally and a vital crop in Sri Lanka, particularly in the Dry and Intermediate zones. This survey was conducted to assess the major challenges faced by maize farmers and the agronomic practices they adopt in the Horowpathana area of the Anuradhapura District, Sri Lanka. A total of 60 farmers from 12 Grama Niladhari (GN) divisions were randomly selected for the study. Data were collected through a questionnaire survey, and descriptive and inferential statistical analyses were performed. The findings revealed that the majority of maize farmers were aged between 36 and 40 years, with both men and women engaged in cultivation. The majority of farmers were educated, yet a significant proportion did not use organic fertilizers, relying primarily on chemical fertilizers. Herbicide use was common, with all farmers applying it to control weeds after planting maize. The study identified several challenges faced by farmers, including adverse weather conditions such as drying and high winds, which were reported by 18.3% of the farmers. Strong winds were found to cause significant damage to maize plants, particularly during the rainy season. Additionally, farmers experienced financial constraints, spending significant amounts on land preparation, chemicals, seeds, labor, transportation, and harvesting, leading to a low-income economy. Price fluctuations of maize grain, lack of storage facilities, and high transportation costs were also major issues affecting the marketing of maize. Biotic and abiotic constraints, such as weeds, drought, low soil fertility, and high input costs, were identified as key factors limiting production. The study concluded that most farmers did not adhere to recommended management practices, resulting in severe yield losses. Therefore, it is crucial to implement awareness programs to encourage proper management practices, ensuring the sustainability of maize production and safeguarding the local economy.

Keywords:*Cereals, Fertilizers, Herbicides, Maize, Management Practices.*

1. INTRODUCTION

Maize (*Zea mays* L.) is the third most significant cereal crop globally after wheat and rice [1]. Around 880 million tons of maize are produced annually on more than 175 million hectares of land spread throughout 166 countries [2]. Although maize is grown all over the world, it has been ranked according to the cultural regions of America, Asia, Africa, and Europe. Essentially, there are three main uses for maize: 21 percent for human nourishment, 72 percent for animal feed, and 7 percent for the industrial sector [3]. Its demand is rising daily as a result of the availability of different food products, animal and poultry feed, fuel, and raw materials for industry [4].

In Sri Lanka, maize ranks as the second most important cereal crop, consumed either as grains or green cobs. In 2020, Sri Lanka imported 50 thousand tons of maize, a 57.26% decrease from the 117 thousand tons imported the year before. In 2020, Sri Lanka's export volume was 5.81 metric tons, with a value of USD 32.77.

It is mostly planted as rainfed cultivation during the Maha season in the Dry and Intermediate zones [5]. The main issues with the cultivation of maize are biotic and abiotic factors. Drought, salt, extremes in temperature, and a lack of nutrients are some of the main environmental factors that have a negative impact on maize yield. In particular, recent severe droughts, waterlogging, and excessive temperatures have adversely damaged maize growth and yield [6]. 60% of China's maize planting area is susceptible to drought, which results in a 20%–30% annual yield loss; in India, waterlogging causes a 25%–30% annual yield loss [7].

Comment [TF1]: Why are here examples of China and India shown, if the paper is about maize in Sri Lanka? Maize has different issues in different cropping regions and climates; it would be interesting, what the real issues in Sri Lanka are.

The district of Anuradhapura is situated in Sri Lanka's North Central Province. There are 694 Grama Niladhari Divisions and 22 Divisional Secretariat Divisions in the Anuradhapura District. Horowpathana is the second-largest Divisional Secretariat in the Anuradhapura District and composed of 38 Grama niladhari Divisions. One of the largest DS divisions in the Anuradhapura district is Horowpathana, with 10700 hectares allocated to maize farming. In the Horowpathana DS division, the majority of people live in poverty and rely on agriculture as their primary source of income. Among them, a particular proportion work in the Anuradhapura district's maize cultivation. The district's climate and abundance of land make it a desirable place to grow maize. The best sites to cultivate maize are those with dry climates and good soil since they allow for the best crop production. In the Anuradhapura district, farmers face a variety of issues before and after maize farming, ranging from production, processing, and storage [8].

The present study was conducted to determine to assess the major challenges faced by maize farmers and the agronomic practices they adopt in the Horowpathana area of the Anuradhapura District, Sri Lanka.

2. MATERIALS AND METHODS

This study was conducted in Horowpathana Divisional Secretariat division in Anuradhapura district. Anuradhapura district is one of the predominantly Maize cultivating areas in Sri Lanka. Horowpathana DS division is one of the major DS divisions in Anuradhapura district where 10700 ha is used for maize cultivation. The study's target population was Maize farmers in Horowpathana DS division, which includes the GN divisions; Morawewa, Maradankadawala, Madawachchiya Junction Nanumillawewa, walahaviddawewa, Puhulewewa, Thirappankadawala, Rasnakawewa, walimuwapothana, kalpe, wadigawewa, and Morakawa. Simple random sampling method was used for the study. The sample size was decided as 60 farmers. Farmers were selected in proportion to the number of Maize farmers available in each GN division. The primary data were collected from Maize farmers in selected GN divisions using structured questionnaires through personal interviews. Secondary data were gathered from different sources such as Agrarian Service Center, Agricultural instructor in Horowpathana DS division in Anuradhapura district. The collected data were arranged to Microsoft excel 2016, worksheet properly. Then statistical analysis was done using the Minitab statistical software package. Descriptive and inferential statistical analyses were done to present the results.

3. RESULTS AND DISSCUSION

This survey was conducted to evaluate the agronomic practices adopted by maize farmers in the Horowpathana area. The results of this survey and discussion are presented in this chapter.

3.1. Socioeconomic Status of Maize farmers

Table 1 describes the socio-economic data of maize farmers in the Horowpathana area. When considering the gender of the farmers, it can be seen that both the male and females were engaged in maize cultivation. However, the majority was represented by the women (63.33%) while males were 36.67%. This might be because most females are willing to cultivate high demand cereal such as maize, millet, paddy etc.

This survey revealed that the age group of 36-40 showed a higher percentage than other age groups while a lower percentage was reported in 25-30 followed by 61-70 age groups. The middle-aged people have been actively involved in maize cultivation in this area. It clearly showed that the young generation did not favour engaging in maize cultivation in the Horowpathana area, which might be due to the present lifestyles in the young age.

According to these results, the majority of the family size represented four members in the selected sample. It can be seen that different family sizes was engaged in maize cultivation. However, the family size of 4 members showed a higher percentage followed by ~~two family~~ families with two members~~sizes~~.

Table 1: Socioeconomic characteristics of maize farmers in Horowpathana area (n=60)

Socioeconomic data		Percentage
a). Gender	Male	36.67
	Female	63.33
b). Age (Years)	25-30	5
	31-35	10
	36-40	20
	41-45	15
	46-50	18.33
	51-55	13.33
	56-60	11.67
	61-65	5
	66-70	1.6
c). Family (members)	1	1.67
	2	16.67
	3	20
	4	31.67
	5	13.33
	6	11.67
	7	3.33
	8	1.67
d). Education Level	A/L	25
	Grade 10	3.33
	Grade 5	1.67
	Grade 8	5
	O/L	65
e). Source of income	Daily Labor supply	31.67
	Private Service	13.33
	Self-Employment	55
f). Land size (acre)	1	10
	2	25
	3	25
	4	16.67
	5	18.33
	6	1.67
	7	1.67
	8	1.67

When considering the level of education of the people in the Horowpathana area, it can be seen that the percentage of maize farmers who have passed the GCE Advanced Level was 25%. The percentage of maize farmers who have passed the GCE Advanced Level was 25%, and the

percentage of maize farmers who have passed the GCE O/L was 65%. Also, the percentage of farmers who have studied up to grade 10 was 3.33%, the percentage of farmers who have studied up to grade 8 was 5%, and the percentage of farmers who have studied up to grade 5 was 1.67%. The findings clearly showed that the majority of the people showed the level of education up to GCE O/L compared to other levels of education. Further, it showed that there was less percentage of poor level of education among the selected farmers. This could be due to the people's attraction to the school education in the country. Therefore, it could be concluded that the majority of farmers have a considerable education level.

The survey results revealed that 55% of farmers had self-employment as a source of major income while 31.67% of farmers involved the daily labour supply. The findings clearly stated that the majority of selected farmers have engaged in self-employment while cultivating maize. This might be due to the poor profit that can be gained by cultivating maize in the Horowpathana area. The lowest percentage of farmers involved in the private sector as a source of income ~~(~~war 13.33%~~)~~. However, Esham[9] reported that the private sector has played an important supportive role in this endeavor as many private sector companies are taking an active role in promoting maize production. These companies mainly contribute through contract farming arrangements, where inputs, including hybrid seeds and loan facilities, are made available to farmers and the companies purchase the produce. Abesuriya [10] reported that seeds required to cultivate this crop, which has been a traditional chena crop for a long time, were produced from previous cultivations, and the use of chemical fertilizers was not required when cultivating in new dale chenas. As it utilizes the labour of the farming family very efficiently, the financial benefit to the family labour unit is high.

When considering the land size of the selected farmers, most of the farmers (18.33%) had a 5-acre land size followed by 4 acres (16.67%) land size to cultivate maize in the Horowpathana area. The results showed that there were different sizes of lands that were used for cultivation. Previous research findings of Damalas & Khan, [11] revealed that the amount of land under cultivation has a significant effect on safe pesticide usage.

3.2. Season of cultivation

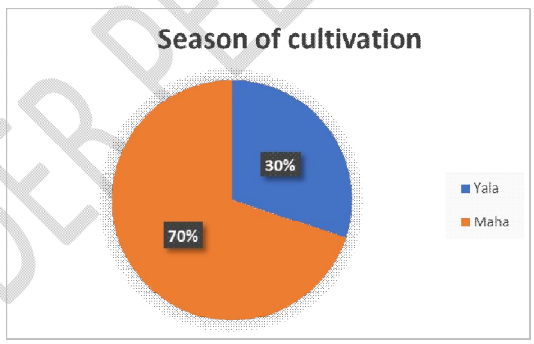

Figure 1 Season of cultivation used in maize farmers in Horowpathana area (n=60)

Figure 1 shows the cultivation period of maize farmers in the Horowpathana area. From the selected samples, each farmer has cultivated in both Yala and Maha seasons. During Yala season, the water supply requirement was fulfilled by using irrigation, while during Maha season, it was fulfilled with rainwater. The results clearly showed that 70% of farmers were engaged in maize cultivation while 30% of farmers cultivated during the Yala season. This might be due to the distribution of rainfall pattern in Sri Lanka. The amount of rainfall is much higher during the Maha season compared to the Yala season. Most of the farmers attempt to cultivate more lands during Maha season, resulting in higher yield than the Yala season. It was evident that most of the farmers cultivated maize in 'chena' during Maha season while in paddy lands during Yala season.

Comment [TF2]: It would be good to explain, when the Yala and teh Maha seasons are. Internationally these terms are not common.

Comment [TF3]: Pls. Explain/translate 'chena'

According to the Punyawardena [12] most of the districts in Sri Lanka received rainfall mainly from the Northeast monsoon, which begins in mid-September and extends up to mid-March in the following

year. Therefore, the major cultivation season in this area called Maha also begins in October and extends up to March.

Ashoka & Sunil, [13] reported that the period's during which the crop would perform best for maximum yields. It is important that the date of planting should be so adjusted that the crop attains vegetative growth rapidly, and the foliage does not allow for wastage of solar energy for a longer period during seedling growth. Thus, is better to choose a proper time for planting, keeping in tune with the season and adjustability of the crop.

Comment [TF4]: What does that mean? That the Maha season is the season for best crop performance? Pls. change to make the meaning clear.

3.3. Soil type

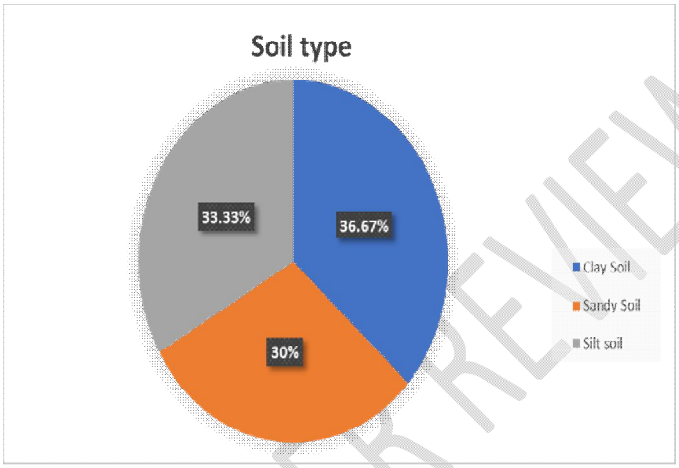

Figure 2: Soil type in Horowpathana area (n=60)

Figure 2 shows the type of soil that prevailed in a study area. The results showed that clay soil represented a higher percentage (36.37%), followed by sand and silt soils. Silt soil had the lowest percentage (33.33%) compared to other soil types. The soil in this area is more suitable for maize cultivation, and the maize plant grows well and gives a good yield.

Comment [TF5]: You mean the silt soil? Pls. say so.

Abesuriya [10] reported that deep loamy soils which are not highly acidic or alkaline are more suitable for maize cultivation. Its PH should be between 5.8-7. This crop grows well in reddish-brown soils found in dry and intermediate regions of Sri Lanka.

Parihar et al., [14] reported that maize could be grown successfully in a variety of soils ranging from loamy sand to clay loam. However, soils with good organic matter content with high water holding capacity and neutral pH are considered good for higher productivity. Being a sensitive crop to moisture stress particularly excess soil moisture and salinity stresses; it is desirable to avoid low lying fields having poor drainage and also the field having higher salinity. Therefore, the fields having provision of proper drainage should be selected for cultivation of maize.

3.4. Land Preparation Equipment

Table 2 shows the land preparation equipment used by maize farmers in Horowpathana area. As per the results of this survey, all selected farmers have used mamoty to clear weeds in the field. This tool is used in both primary and secondary landscaping methods. The majority (70%) of farmers use disc plough to break down the hard layer on the soil surface. This involves turning the soil to a depth of about 30-35 cm from the soil surface. Farmers also used hook plough (30%) to prepare the land. This was also used to prepare the primary ground. Some farmers have used a rake (30%) to clean up the field by collecting debris, weeds and small pieces of wood.

Comment [TF6]: What is a mamoty? A hoe? A cutlass? Pls. explain

Comment [TF7]: Is this really a „hook plow" or ard plow for animal traction, or do you mean a chisel cultivator?

Table 2: Land Preparation Equipment use in Horowpathana maize farmers (n=60)

Land preparation equipment's	Percentage
Mamoty	100
Disc plough	70
Tine tiller	30
Rake	30

Abesuriya[10], reported that it is advisable to turn the soil with a disc plow and crush the ~~stones~~ clodswith a rotavator. If the soil is not well leveled, the seeds may not germinate well in some places due to changes in moisture dependence.

Comment [TF8]: This is obsolete knowledge in times, when globally Conservation Agriculture or Regenerative Agriculture without any tillage are promoted. Pls. mention this in some place.

3.5. Ploughing depth (cm)

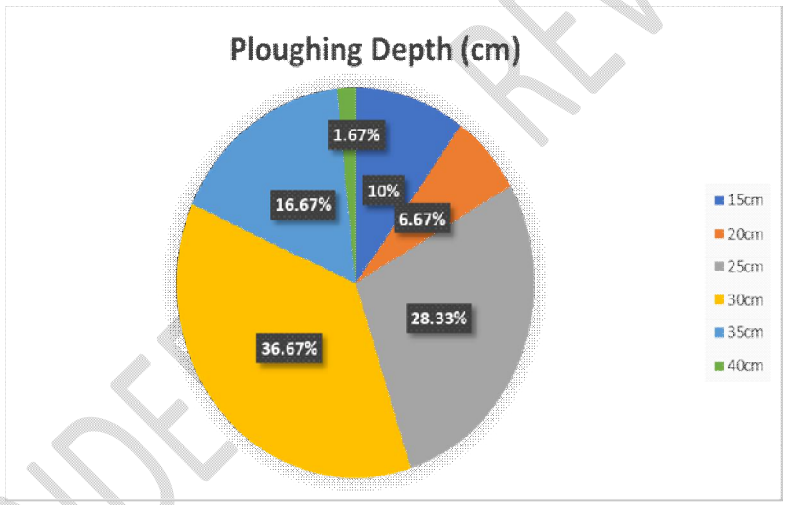

Figure 3: Ploughing depth used~~in~~ byHorowpathana Maize farmers (n=60)

As seen in the figure 3, describes the various ploughing depths applied by maize farmers in the Horowpathana area. That is, how deep the farmers do the ploughing before planting the maize. It was observed that most farmers ploughed to a depth of about 30cm (36.67%), and the minimum was about 15cm (10%). However, it has been recommended by the department of agriculture, Sri Lanka to a depth of about 45cm for maize cultivation. Furthermore, the farmers in this area followed their farming method, and they did not follow the recommended issued by the Department of Agriculture.

Abesuriya [10] reported that the root system of the corn plant extends to a depth of 120-150cm. But the most nourishing part of the tree is its first 45cm. Therefore, when preparing the soil, the soil should be dug to a depth of at least 25cm and the seeds should be crushed prepared for planting.

3.6.Spacing (cm)

Table 3. Spacing (cm) use in maize farmers in Horowpathana area (n=60)

Spacing	Percentage
60*30	33.33
60*60	66.67

Table 3 shows the gap between two maize plants based on the information obtained from the field survey. This survey revealed that a higher percentage of farmers (66.67%) used 60*60 spacing between rows and plants, respectively. If the farmers used 60*60 spacing, they put two seeds per hole while if the farmers used 60*30 spacing, and they put one seed per hole. However, most of the farmers in the study area planted seeds with spacing 60cm x 60cm. Both spacing methods is recommended by department of agriculture Sri Lanka. When provided enough space to grow, plants will have yielded more. Therefore, it could be concluded that the following recommended spacing methods can ~~be~~ increase maize yield.

Abesuriya [10] reported that the recommended maximum yielding plants are 55000 plants per hectare and 22000 plants per acre. Seeds are planted at a spacing of 60*60cm with two seeds in one place and one seed at a spacing of 60*30 cm in one place. Imported hybrid seeds are suitable for planting in this way.

Plant density per unit area is one of the important yield determinants of crops. Hybrid varieties are known to be highly input responsive, and the management practices used for open-pollinated varieties may not be appropriate to exploit the hybrid vigour of F1 generation. Concerning rice, Jayawardena and Abeysekara (2002) reported significant yield variations across different locations and concluded that spacing recommended for inbred varieties should be altered for hybrids.

An optimum plant population for maximum economic yield exists for all crop species and varies with cultivar and environment [15]. The number of plants per unit area of land depends on the variety, its maturity, the productivity of the soil and the water supply.

Verkuijl et al.,[16] reported that the best way to get uniform plant stands is to plant in regularly spaced rows and at regular intervals within the row.

3.7.Seed rates (kg/ha)

Table 4. Seeds rate (kg/ha) of maize farmers in Horowpathana (n=60)

Seed rate (kg/ha)	Percentage
10.00	40.00
10.50	1.67
11.00	5.00
12.00	31.67
12.50	1.67
13.00	6.67
13.50	8.33
13.75	5.00

The 4 table shows the requirement of seeds per hectare that have used by maize farmers in the selected area. AS per the results of this survey, farmers in the Horowpathana area used different rates per hectare. However, a higher percentage of farmers (40%) used about 10kg per hectare while the lowest was 10 ½ kg per hectare. However, the Department of Agriculture has recommended that 13kg per hectare is an acceptable level to obtain a higher yield. Some farmers planted one seed per hole, while some planted two seeds per hole. This could be the reason to use a lower seed rate in a higher percentage of farmers. Even when cultivated on a large scale, the seed requirement varies from farmer to farmer due to external influences such as damages by animals, birds and adverse weather conditions.

Abesuriya[10] reported that due to various deficiencies in the locally produced seeds distributed among the farmers, about 20kg of seeds are required per hectare. The seedling percentage of

Comment [TF9]: Do you mean the germination percentage when you write „seedling percentage“? Pls. Correct.

imported hybrids safely packed is about 95%. Therefore, it is sufficient to plant about 13kg of seeds per hectare.

3.8. Varieties

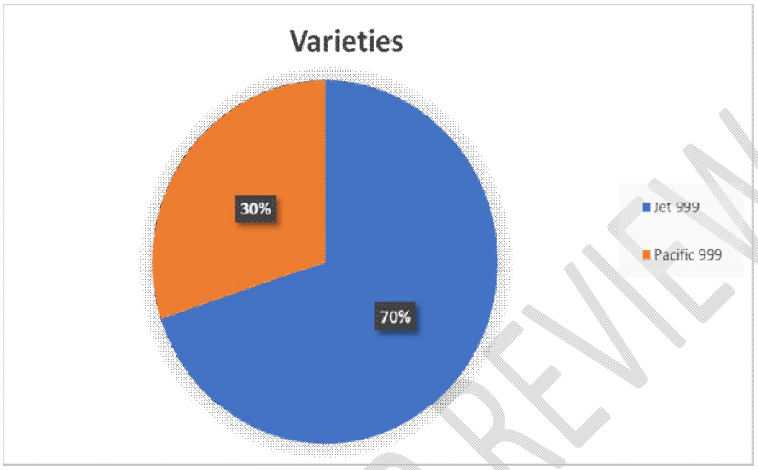

Figure 4: Varieties use in Maize farmers in Horowpathana area (n=60)

Figure 4 shows the major varieties used by maize farmers in the selected area. It was observed that the majority of farmers (70%) had used variety Jet 999 while 30% of farmers have used variety Pacific 999. None of the maize farmer in study area ~~was~~ has not used local maize varieties. This might be because the hybrid varieties resulted in higher yields and more resistance to diseases and pests, even to adverse weather conditions. Yields from local seeds were much low and susceptible to various diseases and problems. Therefore, the majority of farmers used hybrid seeds instead of local seeds.

Yan [17], reported that hybrids' growth characteristics and nutrient requirements in any crop are different from the inbred varieties. Concerning hybrid rice it was observed that the agronomic management of hybrid varieties differed considerably from inbred varieties.

An optimum plant population for maximum economic yield exists for all crop species and varies with cultivar and environment [15]. The number of plants per unit area of land depends on the variety, its maturity, the productivity of the soil and the water supply. Hybrids have demanded further increases in plant populations for the most profitable returns [18]. Plant variety and planting spacing usually affect the crop environment, which influences crop growth and yield. Maize varieties greatly impact yield, and hybrid varieties produce more than double that of local varieties. Cultivation of hybrid varieties along with various planting spacing can increase the production of maize [19].

3.9. Price of seeds (1kg)

Table 5: Price of seeds (1kg)

Price of Seeds (LKR/1kg)	Percentage
1500	30.00
1700	70.00

This table 5 shows that prices of 1kg of seeds that has been spending by maize farmers in Horowpathana area. In the selected sample, 70% of farmers used variety Jet 999 , and it was cost up to 1700 LKR ,while another 30% was used Pacific999 and it was cost up to 1500LKR. It was obvious that most farmers in selected samples were used high priced variety. The majority of farmers said that variety Jet 999 had a higher yield and lightweight than variety Pacific 999.

3.10. Depth of sowing (cm)

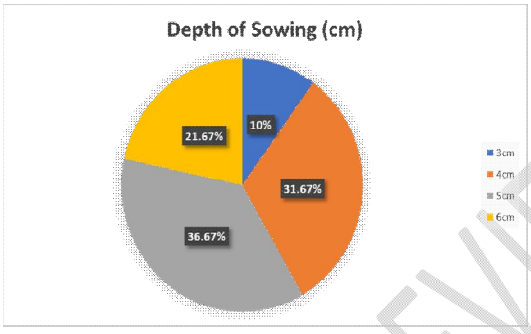

Figure 5. Depth of sowing (n=60)

Figure 5 shows how deep the farmers planted the seeds in the selected sample. The findings clearly showed that a higher percentage of farmers (36.67%) have planted at a depth of about 5cm followed by 4cm (31.67%) while the lowest percentage (10%) was planted at about 3cm. Department of Agriculture, Sri Lanka said that planting maize seeds at a depth of 4-5cm will enhance seed germination and develop a well spread root system. It was observed that the majority of maize farmers in the Horowpathana area had followed the optimum sowing depth, which the department of agriculture Sri Lanka has recommended. If the maize seeds are planted at a depth of more than 4-5cm, the germination rate will also decrease. Planting less than 4-5cm also increases the risk of damage to animals, such as rats, rabbits, pigs, monkeys, and Birds.

Abesuriya[10], reported that planting depth should also vary slightly depending on soil condition. Seeds should be planted at a 4-5 cm depth in light loamy soils and shallower on loamier soils, while Verkuijl et al., [16], reported that the adequate seed depth is 5–7 cm, as deeper planting retards germination. In dry areas, maize seeds may be planted more deeply and then covered with soil.

3.11. Sowing Equipment

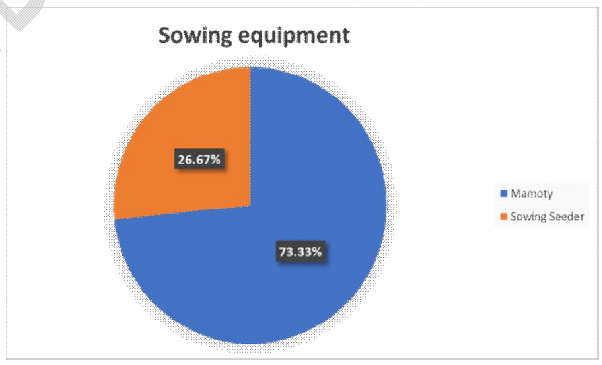

Figure 6: Sowing Equipment used in Horowpathana maize farmers (n=60)

Figure 6 shows that major sowing equipment used farmers in selected sample. From the selected farmers, 73.33% used mamoty for sowing purposes, while 26.67% used ~~sowing a~~seeder. It was observed that the majority of farmers had used mamoty as sowing equipment. This might be due to the cheap availability of mamoty than other sowing equipment. Abesuriya [10], reported that seed planting could be done by hand or by seed dispersal.

Comment [TF10]: Pls. Specify, what kind of seeder - manual, precision, tractor mounted? A mechanized precision seeder for single grain seeding is usually called a planter.

3.12. Organic Fertilizer (Apply)

Table 6: Organic Fertilizer usage in Horowpathana maize farmers (n=60)

Organic fertilizer	percentage
Yes	36.67
No	63.33

Table 6 shows the organic fertilizer usage in the selected sample. The results showed that most farmers did not use organic fertilizers, and it was 63.33%, while 36.67% of farmers used organic fertilizers. Most of the farmers in the selected area was accustomed to using chemical or inorganic fertilizers, and only a few used organic fertilizers.

This is due to the fact that chemical fertilizers are readily available to the crops as well, as it encourages faster growth in plants compared to organic fertilizers. Further, organic fertilizer takes some time to decompose and to release nutrients which are required for the plants. Therefore, the majority of farmers were accustomed to using inorganic fertilizers.

Abesuriya [10], reported that adding about 10 tons of compost per hectare at the time of land preparation can give a very high yield. Dugje et al., [20] reported that farmers cope with low soil fertility and Striga through the use of crop rotation, organic manure and inorganic fertilizer.

Ashoka & Sunil [13], reported that organic manure certainly has a great impact on plant growth and yield. The way the fertilizers are applied for each crop depends on its rooting pattern, planting, and cultivation requirements. The nutrients supplied thus influences better root growth, early emergence and expansion of leaf canopy, and increases photosynthetic efficiency, resulting in greater dry-matter production. These eventually lead to the formation and development of larger sink where the food material accumulates like grains, tuber, etc., and ultimately provides higher grain yield.

Verkuijl et al., [16], reported that the maize plant has a relatively high demand for nutrients, particularly nitrogen (N), phosphorus (P), and potassium (K). These nutrients may be obtained through farm yard manure (FYM) and/or inorganic fertilizer applications.

3.13.Type of Organic Fertilizer

Table 7: Type of Organic Fertilizers used by maize farmers in Horowpathana area (n=60)

Type of Organic fertilizer	**Percentage**
Animal Waste	10.00
Crop Residues	26.67

Table 7 shows kind of organic fertilizer used by farmers in selected Grama Niladhari areas. As per results higher percentage of farmers used crop residues as an organic fertilizer while 10% used animal waste. The farmers used a variety of crops residues such as Black gram, Green gram, Groundnut, Cowpea, straw and decayed leaves. About 10% of farmers have used cow dung, poultry

manure, and Goats manure as animal waste. All kinds of waste can be easily found by the farmers in the surrounding area.

Verkuijl et al., [16] reported that Crop residues were used as soil amendments by 61% of farmers, who ploughed the residues back into the soil. Thirty-six percent reported burning crop residues, and only 3% fed residues to livestock

3.14. Application of fertilizer

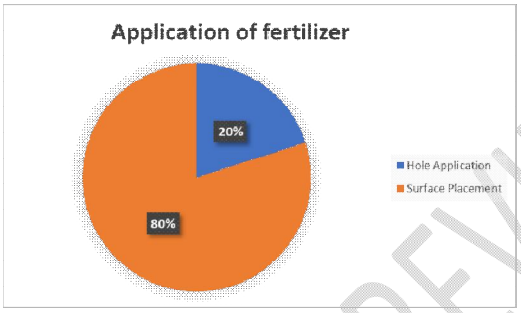

Figure 7: Fertilizer application methods used by maize farmers (n=60)

Figure 7 shows the fertilizer application methods used by selected farmers in Horowpathana. As per results mainly they were used two methods. It was observed that 80% of farmers used the surface placement method while 20% used the hole application method. In surface placement, apply fertilizer to the surface of soil nearby root area. In hole placement, dig a small hole near the root of the plant and apply fertilizer. As per results higher percentage of farmers used surface placement. This could be due to the higher efficiency, less time and labour requirement than the hole placement method.

Abesuriya[10], reported that hybrid maize varieties are highly responsive to fertilizer. Many maize growers are accustomed to applying surface fertilizer to them at least twice, based on their experience in the field. However, Verkuijl et al., [16] reported that Fertilizer is normally placed 5 cm below the soil and about 5 cm to the side at the time of planting. This is accomplished by digging a single hole beside each seed, placing fertilizer in the hole, and covering it with soil.

3.15. Seeding method

Table 8: Seeding method (n=60)

Seeding Method	Percentage
Row Seeding	100

Table 8 shows seeding method used by farmers in the Horowpathana area. According to the findings of this survey, all the selected farmers have used the row seeding method. This might be due to the being C4 plant maize needs more sunlight. When planting the seed in a row facing east to west, it can catch up more sunlight, promoting good growth and photosynthesis in the maize plant. Further seeding is done in row manner. It is easy to control weeds, and even it makes crop monitoring and fertilizer application easier.

Abesuriya[10] reported that most farmers dig small holes into 30 to 30 cm or 60 to 60cm in rows and plant the required number of seeds in rows. Bakht et al., [21] reported that inappropriate planting methods significantly reduce maize production. Adopting modern management practices is imperative for boosting per hectare maize yield, and planting method is an important agronomic practice for

Comment [TF11]: In the entire paper there is no single mention of a modern (sustainable) management practice. Pls. expand.

enhancing crop yield. Inappropriate planting methods caused a reduction in germination, growth and development, ear size and increased susceptibility to diseases and lodging.

3.16. Method of weed control

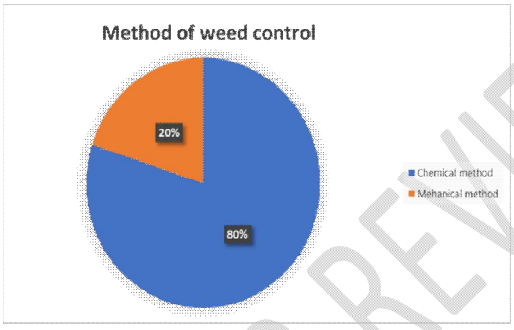

Figure 8: Method of weed control (n=60)

Figure 8 shows weed control methods adapted by maize farmers in Horowpathana area. It was noticed that 80% of farmers used chemical methods to control weeds while 20% was used mechanical methods. Obviously, most of the farmers in Horowpathana area used chemical to control weeds rather than using other environmental healthy methods. This might be due to the quick action of weedicides and their availability to the farmers. Further, controlling weeds with chemicals facilitates less labour requirement and cost than mechanical weeding methods such as manual weeding.

Abesuriya[10], reported that mechanical or chemical weed control is very important when cultivating maize on a large scale as weed control is required without delay to affect the yield. A rotavator attached to a two-wheeled hand tractor can easily control weeds between rows of plants. Onyibe et al.,[22] recommended that pre- and post-emergent herbicides effectively control non-parasitic weeds in the West African savannas.

3.17. Other major Problems

Table 9: Other major problems faced by maize farmers in Horowpathana. (n=60)

Problems	percentage
Money problems	100
Labors	100
Market	100

The table 9 shows the problems ~~that have been facing by~~ selected farmers have been facing in Horowpathana area. It was observed that 100% of selected farmers faced problems due to money, labour and market facilities. Furthermore, the economy of the farmers in this area is very low, and the farmers faced all the problems mentioned in the table above. At present, there is no good marketing facility to sell their final yields.

3.18. Yield (kg/acre)

Figure 9 shows the yield in kilograms obtained by the farmers per acre. It was observed that 31.67% of farmers obtained 1900-2000kg/acre while a minimum of 5% of farmers resulted in 2000-2100kg/acre. The Department of Agriculture has recommended a maize yield of about 2300kg per acre. This could be because most farmers did not follow recommended management practices issued by the department of agriculture.

Furthermore, adverse weather conditions also affect final yield. It was proved by Nesmith and Ritchie [23], they reported that maize yield can be reduced by as much as 90% if drought stress occurs between a few days before tassel emergence and the beginning of grain filling. Under induced moisture stress from the tassel-emergence stage to the end of the crop cycle of maize, Badu-Apraku et al., [24] observed a yield reduction of 62% compared with well-watered plants.

Maize is sensitive to drought at the seedling, flowering and grain-filling stages. Drought, which coincides with the flowering and grain-filling periods, can cause serious yield instability at the farm level, as it allows no opportunities for farmers to replant or otherwise compensate for the loss of yield.

Abesuriya[10], reported that due to the weaknesses in the field activities of most of the farmers who are already cultivating maize, the average yield from that is a little less than 3 mt per hectare. This is a cropping system of lower productivity than irrigated or protected agriculture due to erratic weather, biotic stresses, and poor adoption of improved agronomic practices. Thus, even though maize has a high potential yield, and the farmers have failed to achieve this potential yield at field conditions [15].

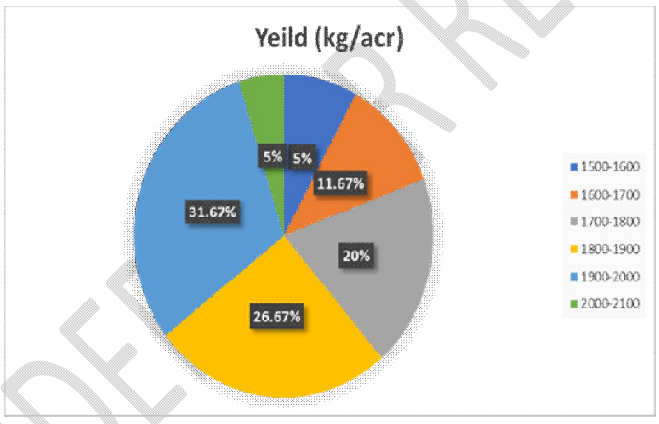

Figure 9: Yield (kg/acre) (n=60)

3.19. Cost (Rs/acre)

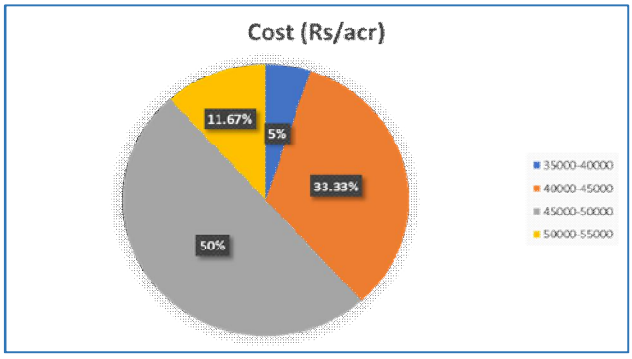

Figure 10: Cost (Rs/acr)

Figure 10 shows the details of the cost incurred by farmers for their cultivation. It was observed that 50% of farmers had spent 45000-50000LKR/acre while 5% was spent 35000-40000LKR/acre. The majority of farmers spent a higher amount on their cultivation, and this could be due to the higher input costs in the market. Mainly, they spent a higher amount on land preparation, chemical, seeds, labor, transportation, and harvesting.

4. CONCLUSION

The findings of this study indicate that the agronomic practices adopted by maize farmers in the Horowpathana Divisional Secretariat division of Anuradhapura District are significantly influencing maize yield. The study shows that most farmers are not fully aware of the recommended agronomic practices provided by the Department of Agriculture. While they utilize suitable soil types and proper seed spacing, there is limited adherence to best practices in areas such as fertilizer use, pest control, and weed management. Despite this, the majority of farmers rely on hybrid varieties and follow optimal sowing depths, which have a positive impact on yield. A major challenge identified is that farmers predominantly use inorganic fertilizers and chemical pest control methods, with little engagement in organic alternatives or more sustainable practices like earthing up and mulching. Moreover, the farmers face significant economic challenges due to high input costs, labor shortages, and limited market facilities, which affect their overall productivity and profitability. Adverse weather conditions, including strong winds and drought, further exacerbate the difficulties in maize cultivation. The results suggest that the hypothesis regarding low awareness of recommended agronomic practices among farmers is valid. This lack of awareness is contributing to suboptimal yields and higher production costs. To address these challenges, it is crucial to implement awareness programs aimed at educating farmers about the importance of following the Department of Agriculture's guidelines. Additionally, farmers need to be introduced to more sustainable and cost-effective agricultural practices to improve both yields and economic conditions in the region. Future studies could focus on evaluating the impact of specific training programs on farmer productivity and the effectiveness of integrating organic practices into maize cultivation. In conclusion, while there are some positive practices in place, the low adoption of recommended agronomic practices, economic challenges, and external factors like weather significantly hinder the full potential of maize farming in the area. There is a pressing need for better education, support, and practical solutions to increase sustainability and productivity in maize farming in Horowpathana.

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