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Comparative Effects of Potassium Iodate and SAAF-Fungicide on the Control of *Fusarium* Wilt (*Fusarium oxysporum*) And the Yield of Pepper (*Capsicum spp.* L.)

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ABSTRACT: SAAF Fungicide is a systemic and contact fungicide that is used to prevent leaf spot, blast disease, rust disease, and other types of fungi pests in all kinds of crops, especially on vegetable plant. Hence, the objective of *this paper as to compare the effects of Potassium Iodate and SAAF-fungicide on the control of Fusarium Wilt (Fusarium oxysporum*) and the Yield of Pepper (Capsicum spp L.) using appropriate standard methods. Agronomic data such as number of leaves, plant height and flowers was collected. Disease incidence and severity as well as yield were measured and analyzed using Analysis of Variance (ANOVA). Among all the treatment, Gulpinar F1 with KIO_3 has the highest height and number of leaves across the experiment while negative control has the least height and number of leaves. De cayenne with SAAF has the highest yield of pepper harvested followed by Gulpinar F1 with KIO_3, the negative control has the highest disease infection and severity, there are very mild infection on the treated plots. The two treatments have positive effect on the growth, disease control and yield of pepper. The highest pepper yield was achieved from SAAF treated sample.

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Pepper (Capsicum spp.), has a sweet or pungent smell, it belongs to the Solanaceae family and is an important vegetable crop in Africa and the world in general. The global production of green and dry peppers in 2016 was estimated at over 38M tons, in which Africa produced over 4M tons (FAOSTAT, 2016). Pepper is a rich source of vitamin A, E and it contains up to six times the vitamin C contained in an orange or lemon which makes the crop an ideal vegetable for prevention of flu. Pepper also contains minerals and fibres and are used in many cuisines globally (Endriyas and Tola, 2020).Chili pepper has preventive and therapeutic properties for many ailments such as different types of cancer, rheumatism, stiff joints, bronchitis and chest colds with cough and headache, arthritis, heartarrhythmias and is used as stomachic (Pawar *et al.*, 2011). Production of pepper has numerous constraints which include; high cost of seeds, lack of proper and adequate inputs, insufficient improved varieties, drought stress, poor soil fertility, storage facilities problem, fluctuations of prices, non-availability of credit, lack of technical knowhow at the farm level and severe attack by diseases and insect pests (Mohammed *et al*., 2016; Orobiyi *et al*., 2013; Tesfaw, 2013). Fungal, bacterial and viral diseases as being the most challenging threats in production of pepper (Dagnoko *et al*., 2013). Viral diseases in pepper has caused significant economic losses by

reducing both fruit quality and quantity (Abdalla *et al*., 1991). Other various diseases affecting pepper production are Powdery mildew, Leaf blight, Wilt and Pepper mottle virus (Kassahun *et al.,* 2016). Pepper wilt has become the leading causing pathogens in pepper cultivation (Assefa *et al.,* 2015). Fungal diseases are one of the major constraints that affect the production of pepper in Africa (Kassahun *et al.,* 2016). The plant health is an important factor that determines its productivity. *Fusarium* wilt disease can cause substantial yield loss in pepper production and farmers have resorted to the use of fungicides in controlling the disease because of the chemicals quick and effective action (Goldberg 2010). *Fusarium* spp. are species of fungi that can lead to the total death of the plant at severe stages. The pathogen invades the vascular tissues, grow in vascular bundle and inhibit water flow consequently causing wilting, ultimately leading to death of plant. SAAF Fungicide is a systemic and contact fungicide that is used to prevent leaf spot, blast disease and rust disease and other types of fungi pests, in all variety of crops, especially on vegetable plants. The active ingredient in SAAF is Carbendazim 12% + Mancozeb 63%.The objective of the research work is to compare the effects of Potassium Iodate and SAAF fungicide on the control of Fusarium Wilt (*Fusarium* oxysporum) and the Yield of Pepper (*Capsicum* spp L.)

MATERIALS AND METHODS

*Study Area***:** The experiment was carried out at Federal University of Agriculture, Abeokuta field trial Plot during the dry season. The University is situated along ($3^{o}23^{1}$E and $7^{o}20^{1}$N). The vegetation of the area lies between the tropical rainforest and savannah region, it has a tropical climate characterized with annual rainfall of about 1037mm, minimum and maximum temperature ranging between 20.66^{o}C and 35.48^{o}C.

Sample Planting: There are two pepper varieties that used Gulpinar F1 and De cayenne seeds, pepper were planted in the nursery and later moved to the pot in the screenhouse. The experimental was arranged in a Completely Randomized Design with 2 factors leading to 6 treatments, each of which was replicated thrice. The experiment consists of two varieties of pepper, two treatments [Potassium Iodate and SAAF] at two of different concentrations, and control pot without treatment. Two pepper seedlings (6 weeks old) were transplanted into each pot filled with sterilized soil. There were 12 pots altogether and each pot was arranged into rows of four with 0.5m between the pots and 1m between replicates.

Isolation of Fusarium spp and Inoculation of Pepper Seedlings A pure *Fusarium spp* was obtained from infected pepper leaves. Conidia suspension of seven days old pure culture of isolated *f. oxysporum f. sp lycopersici* was washed with sterilized distilled water to obtain suspension of inoculums of the pathogen. Culture were then filtered through one layer of Mira cloth, centrifuged, washed with sterilize water and adjusted to a concentration of 10 conidia per ml with the aid of heamocytometer. The already prepared conidia suspension *f. oxysporum f. sp lycopersici* was then used to inoculate 6 weeks old seedling of pepper. The two varieties of pepper were inoculated with 5gram of the mycelia of the pure culture was used. The inoculation was done in the soil very close to the root region of the plant.

*Preparation of Fungicides and Treatment Application***:** SAAF and Potassium Iodate was prepared by weighing 1gram of the powder into 1Litre of water and mixed thoroughly. Pepper plants were treated with Potassium Iodate (KIO_3) and SAAF at 2, 4, 6, 8 weeks after transplanting 0ppm (control), and 10ppm concentration. The fungicide prepared was transferred to foliar sprayer and were applied by spraying early in the morning. There was no spraying on the control pots. Regular irrigation and weeding was done to maintain proper growth of the plant.

*Data Collection and Analysis***:** The data of the agronomic parameters was collected at the 2, 4, 6 & 8 WAP. The agronomic parameters were taken include number of leaves, plant height, number of flowers. Data from disease incidence and severity was collected as well. Disease incidence (DI) was assessed at 6 & 8 WAT and it was calculated using the formulae:

$$\mathrm{DI} = \frac{Number\ of\ infected\ plants\ per\ pot}{Total\ number\ of\ plant\ per\ pot}\ X\ 100$$

Table 1: Severity scale for *Fusarium* wilt

Disease Severity	Symptoms description	Inference
1	No symptoms, on stems and leaves	Immune (I)
2	Very limited wilting, 5% leaves yellowed and wilted	Resistant (R)
3	Limited wilting, 6 -10% leaves yellowed and wilted	Moderately Resistant (MR)
4	Moderate wilting, 11 -20% leaves yellowed and wilted	Moderately Susceptible (MS)
5	Severe wilting 21 -50% leaves yellowing and wilted	Susceptible (S)
6	Very severe wilting, above 50% leaves yellowed and wilted	Highly susceptible (HS)

Disease severity of the *Fusarium* wilt was assessed at 6 and 8WAT through the foliar symptom expressed and visual guide of each stage of the diseases using a

scoring scale in Table 1. Yield **e**valuation was done by taken the weight of pepper fruits that was harvested from each pot. Data collected was subjected to Analysis of Variance (ANOVA) and significant means was separated using the Duncan Multiple Range Test (DMRT).

RESULTS AND DISCUSSIONS

Plant height and Number of leaves: Gulpinar F1 treated with KIO_3had the tallest average plant height and highest number of leaves followed by De cayenne treated SAAF at the end of 2nd week after transplanting, the same tempo was maintained up till the 8 week after transplanting Table:2 and 3.Gulpinar F1 treated with Potassium Iodate performed better than De cayenne treated with KIO3but De cayenne treated with SAAF performed better in terms of height Gulpinar F1, whereas the negative controls are shortest stand and few numbers of leaves within the population used.

Table 2: The mean of plant height

	V1	V2	V1+KIO_3	V2 + KIO_3	V1 +SAAF	V2 + SAAF
2WAT	23.44	21.83	22.61	20.17	20.97	21.77
4WAT	26.07	26.72	31.20	27.83	28.94	30.04
6WAT	29.86	28.60	41.60	35.62	37.71	38.46
8WAT	30.89	32.25	46.59	39.90	42.23	43.07

Note: V1 = Gulpinar-F1 no treatment, V2 De cayenne no treatment

Table 3: The mean of the number of leaves

	V1	V2	V1+KIO_3	V2 + KIO_3	V1 +SAAF	V2 + SAAF
2WAT	36.33	39.67	51.67	46.33	46.33	47.67
4WAT	51.23	55.93	72.85	65.33	63.45	67.21
6WAT	63.01	72.71	94.71	84.93	82.49	87.37
8WAT	49.15	56.71	80.50	72.19	70.11	74.26

Fruit yield: The second variety used De cayenne treated with SAAF had the highest average fruit yield followed by Gulpinar-F1 treated with KIO3 Table: 4.The negative control had 40.0Kg/hectare, pepper treated with Potassium Iodate had 127kg/hectare and 107kg/hectare, plants treated with SAAF performed better had 148kg/hectare and 115kg/hectare. Variety one treated with KIO3 had 200% yield increase, the same variety treated with had 300% increase compare with negative control plot. The second variety treated with KIO3 and SAAF had 200% yield increase compare with negative control.

Disease incidence and Severity: The disease incidence and severity at the sixth week was intense on the negative control plots, the two untreated pepper varieties had the highest diseases incidence of *Fusarium* wilt which was statistically higher than the rest of the treatments. The same trend was maintained at the last week (8WAT) Table: 5 and 6.There were fairly uniformity in the incidence and severity of the disease in the control measures applied, they relatively controlled the disease half way. The disease reduction is up to 60% compared with untreated plot.

Table 4: The mean of the fruit yield (Kg/Hectare)

	V1	V2	V1+KIO_3	V2 + KIO_3	V1 +SAAF	V2 + SAAF
6 WAT	40.00	40.00	127.53	107.40	148.06	115.80

Table 5: The mean of the diseases incidence

	V1	V2	V1+ KIO3	V2+KIO3	V1+ SAAF	V2 + KIO3
6WAT	62.67	63.33	24.33	26.67	25.33	23.67
8WAT	79.33	80.08	30.75	33.83	32.13	30.08

Table 6: The mean of the diseases severity

	V1	V2	V1+KIO3	V2+ KIO3	V1 + KIO3	V2+KIO3
6WAT	4	4	2	1	2	1
8WAT	6	5	2	2	2	2

The research has shown that the application of fungicides had a huge impact on the pepper infected with *Fusarium* wilt. The variety Gulpinar F1 plants that were cultivated with Potassium Iodate had the tallest plant stands, while variety De cayenne plants that were cultivated with SAAF had highest number of leaves. All the pepper plant treated with either Potassium Iodate or SAAF had low diseases incidence and severity. Ravichandran and Hedge (2015) reported that application of the two fungicides contributed positively to the growth and development of pepper plant. Likewise Hwang *et al*. (2022) mentioned that pepper plants treated with any of the two fungicides were not really affected by the *Fusarium* wilt. The two

treatments had better yield and more healthy leaves and shoots. Similar observations were reported by Ajiwe *et al.,* (2019) revealed that treating soil with these fungicides prevent the attack of *Fusarium* wilt on Pepper field.

*Conclusion***:** *Fusarium* wilt is one of the major disease affecting pepper. Two treatments of Potassium Iodate and SAAF were used to prevent invasion of *Fusarium* wilt on Pepper field but the plant with SAAF produced better yield of pepper compare with Potassium Iodate. SAAF is therefore recommended to prevent invasion of *Fusarium* wilt on pepper field.

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