The impact of applying the growth retardant paclobutrazol at various timings on thequality of the strawberry cultivar Chandler (*Fragaria ananassa*) was investigated underPunjab conditions.

Abstract: ThefieldexperimentconductedduringtheRabiseasonof2022aimedtoinvestigatethe impact of foliar spray with the growth retardant paclobutrazol at various timings on thestrawberrycultivarChandler(*Fragariaananassa*Duch).TheexperimentaldesignemployedaRandomizedBlockDesign(RBD)witheighttreatments,eachreplicatedthreetimes.Paclobutrazol was administered at different intervals, specifically at 110, 115, 120, 125, 130,135, and 140 days after planting, along with a control group receiving no spray. The resultsdemonstrated a significant influence of Paclobutrazol spray timing on the quality parameters.Amongthedifferenttreatmentswiththeplantgrowthretardant,Treatment4(PBZ250ppmat125 days after planting) exhibited the highest values for fruit length (31.40 mm), fruit width(25.70 mm), fruit thickness (1.79 mm), fruit weight (12.03 g), Total Soluble Solids (TSS)(9.50°Brix), Firmness (1.92 N) and Titrable Acidity (2.56%) with lowest values observed inthecontrolgroup.

Keywords: Cultivar,Chandler,Growth retardant,*Fragaria ananassa*, Paclobutrazolandtreatments.

Introduction: Strawberry (Fragaria ananassa Duch) is one of the most widely consumed andwell-likedberryfruits.Ithasapleasanttaste,adelicateflavour,andapleasingappearance,allof which contribute to its popularity. Strawberries, in addition to its delightful flavour andsensory qualities, can be categorized as a functional fruit due to their high concentration ofimportant nutrients and phytochemicals. These elements not only enhance the flavour of thefruit, but they also play an important role in supporting human health and overall well-being**[1]**. Strawberry fruit quality is determined by the fruit's size and colour development, butcustomer acceptance is determined by taste, texture, and flavour. The key fruit ingredientsresponsible for the overall strawberry flavour are sugars and organic acids, since their balancedefines the fruit's sweetness and pleasant taste **[2]**. Strawberry farming is a global agriculturaltechnique that takes place in a variety of climates and places around the world. This tasty andnutritious fruit, famed for its sweet and tangy flavour, grows best in well-drained soil andtemperatetocooltemperatures.Majorstrawberry-producingcountriesincludetheUnitedStates, where states like California play a critical role, and China, where provinces likeShandong produce a substantial amount. Spain, Mexico, Egypt, and South Korea are allsignificant contributorsto the global strawberrymarket. Strawberryfarming necessitatesmeticulous attention to details such as irrigation, fertilization, and pest control. The fruit iscultivated on fields, but in some areas, new approaches like as

UNDER PEER REVIEW

high tunnels or greenhousefarmingareusedtolengthenthegrowingseason.Strawberriesarerecognizednotjustfortheirexquisitetastebutalsofortheirnutritiouscontent,makingthemasought-aftercropininternationalmarkets.

Paclobutrazol (triazole derivative), a growth inhibitor, is commonly used to regulategrowth and development by altering associated biochemical and physiological processes. Bysuppressing gibberellin manufacture at the kaurene stage, it has been successfully used toinduce and regulate flowering, fruiting, and plant vigour in numerous fruit crops, resulting inreduced vegetative growth, promising early and copious flowering, and improved quality.When applied before to flowering, it promotes strawberry growth, yield, and quality. Its useincreases the number of blooms per plant, the number of runners and plantlets per runner, thenumber of berries set and the berries yielded **[3]**. Keeping inview the above mentioned facts in mind, the current study was carried out to investigate theviability of applying Paclobutrazol at various spray timings on the quality of strawberry cropinPunjab subtropics.

MaterialandMethods: The studywasconductedoutdoorswithinthe premisesoftheDepartment of Agriculture's Research Farm at Sant Baba Bhag Singh University in Jalandharduring the 2022-2023 period. Its objective was to investigate the impact of varying the timingof foliar spray with Paclobutrazol on the overall quality of strawberries (*Fragaria ananassa*Duch)oftheChandlercultivar**.**Thelocationof thesiteisspecifiedbythecoordinates31.4220North and 75.8087 East. Raised beds, characterized by a finely cultivated soil texture anddevoid of weeds and grasses, were meticulously prepared and covered with black polythenesheetingformulching.RobustrunnersoftheChandlercultivarwereacquiredfromtheRHRSSresearch station in Bhadarwah, Jammu and Kashmir and were planted at the fortnight ofOctober with a 45 cm recommended spacing. Across all experimental treatments, a uniformapplication of the recommended dosage of manures and fertilizers, coupled with consistentpracticesofirrigation,weeding,andhoeing,wasmaintained.Theexperimentallayoutfollowedarandomizedblockdesign(RBD)withthreereplications.Eachplotmeasured4x3meters.

UNDER PEER REVIEW

Thetreatmentgroups wereasfollows:T0-control(nospray),T1-PBZ@250ppm110daysafter planting, T2 - PBZ @ 250 ppm 115 days after planting, T3 - PBZ @ 250 ppm 120 daysafter planting, T4 - PBZ @ 250 ppm 125 days after planting, T5 - PBZ @ 250 ppm 130 daysafter planting, T6 - PBZ @ 250 ppm 135 days after planting, and T7 - PBZ @ 250 ppm 140days after planting. Foliar spraying of Paclobutrazol was initiated in early February andcontinued until the beginning of March. Observations were recorded on different qualityparameterslikefruitlength(mm),fruitwidth(mm),fruitthickness(mm),fruitweight(g),TSS(° Brix),acidity(%)andfirmness(N).Thepooleddatafromoneyearwasstatisticallyevaluatedaccording to Gomez, K. A., and Gomez, A. A. (1984) **[4].** The mean of the qualities wascomparedusingapaired't'test,and theleastsignificantdifferencewas setat5%.

DEMONSTRATION

Plate1Raisingofseed beds

Plate2Manuring

Plate3Applicationoffertilizers

Plate4Mulching

UNDER PEER REVIEW

	
Plate5Plantation	**Plate6Irrigation**
	
Plate7FloweringStage	**Plate8FruitingStage**

UNDER PEER REVIEW

ResultsandDiscussion

A):InfluenceofPaclobutrazolon qualityparametersofstrawberryplant.

A): The assembled results from 2022, shown in Table 1 and 2 indicate that Paclobutrazolsignificantly affected the quality parameters of the strawberry (*Fragaria ananassa*Duch) cv.Chandler.

Table1:Effectofapplicationofgrowthretardant(paclobutrazol)atdifferenttimingsonqualityparametersofstrawberrycv. ChandlerunderPunjabconditions.

Treatments	**Fruitlength (mm)**	**Fruitwidth (mm)**	**Fruitthickness (mm)**	**Fruit weight(g)**
T0	17.20	16.10	1.49	7.36
T1	20.40	19.20	1.55	8.90
T2	24.50	20.50	1.62	9.50
T3	27.70	23.90	1.71	10.60
T4	**31.40**	**25.70**	**1.79**	**12.03**
T5	29.30	23.50	1.75	11.20
T6	29.40	23.20	1.72	10.60
T7	28.20	22.10	1.69	10.03
CD (0.5%)	1.56	0.91	N/A	1.05

UNDER PEER REVIEW

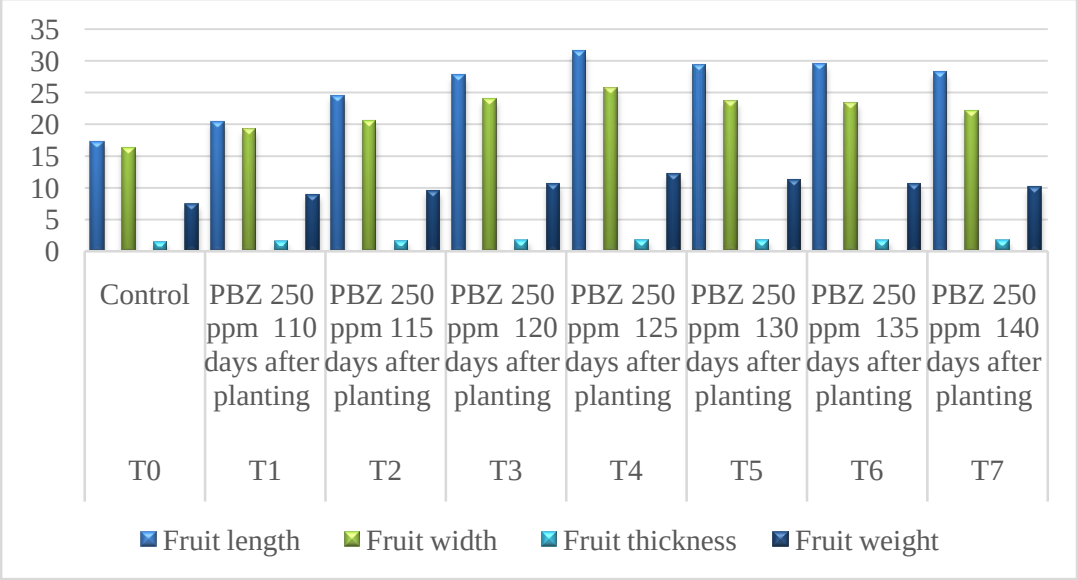

Fig1–Fruit length(mm),Fruitwidth(mm),Fruitthickness(mm)andFruitweight(g)

I) Fruit Length: According to the data, spraying paclobutrazol at varied intervals has asubstantial influence on fruit length. The treatment T4 (PBZ 250 ppm 125 days after planting)produced the longest fruit (31.40 mm). T0 (control) yielded the shortest fruit length. Data alsoshowed that all treatments were much better than the control. The findings match with thepreviousobservationsof **(Kumraetal., 2018) [5]**

II) Fruit Width: The results show that spraying paclobutrazol at different intervals has asignificant influence on fruit width. The treatment T4 (PBZ 250 ppm 125 days after planting)produced the largest fruit (25.70 mm). T0 (control) yielded the smallest fruit width. The dataalso showed that all treatments outperformed the control. The findings corroborate priorobservationsof **(Kumra et al., 2018) [5].**

III) FruitThickness: Thefindingsdemonstratethatsprayingpaclobutrazolatvariousintervals has a significant influence on fruit thickness. The treatment T4 (PBZ 250 ppm 125days after planting) produced the thickest fruit (1.79 mm). T0 (control) yielded the smallestfruit thickness. Furthermore, data revealed that all treatments outperformed the control. Therewas no meaningful effect discovered. The identical values were obtained by **(Al-Raisy*et al.*,2010) [6].**

IV) Fruit Weight: The results indicate that spraying paclobutrazol at different intervals has asignificantinfluenceonfruitweight.ThetreatmentT4(PBZ250ppm125daysafterplanting)produc edthemostfruit(12.03g).T0(control)producedthesmallestfruitweight.

UNDER PEER REVIEW

Furthermore,datashowedthatalltreatmentsoutperformedthecontrol.Thefindingsmatchwiththepreviousobservationsof **(Al-Raisy*etal.*, 2010) [6].**

Table2Effectofapplicationofgrowthretardant(paclobutrazol)atdifferenttimingsonqualityparametersofstrawberrycv. ChandlerunderPunjabconditions.

Treatments	TSS(°Brix)	Firmness(N)	TitrableAcidity(%)
T0	6.60	1.62	2.20
T1	7.50	1.74	2.39
T2	7.60	1.76	2.45
T3	8.00	1.79	2.51
T4	**9.50**	**1.92**	**2.56**
T5	8.90	1.89	2.48
T6	8.83	1.84	2.46
T7	8.50	1.80	2.44
CD (0.5%)	1.43	N/A	N/A

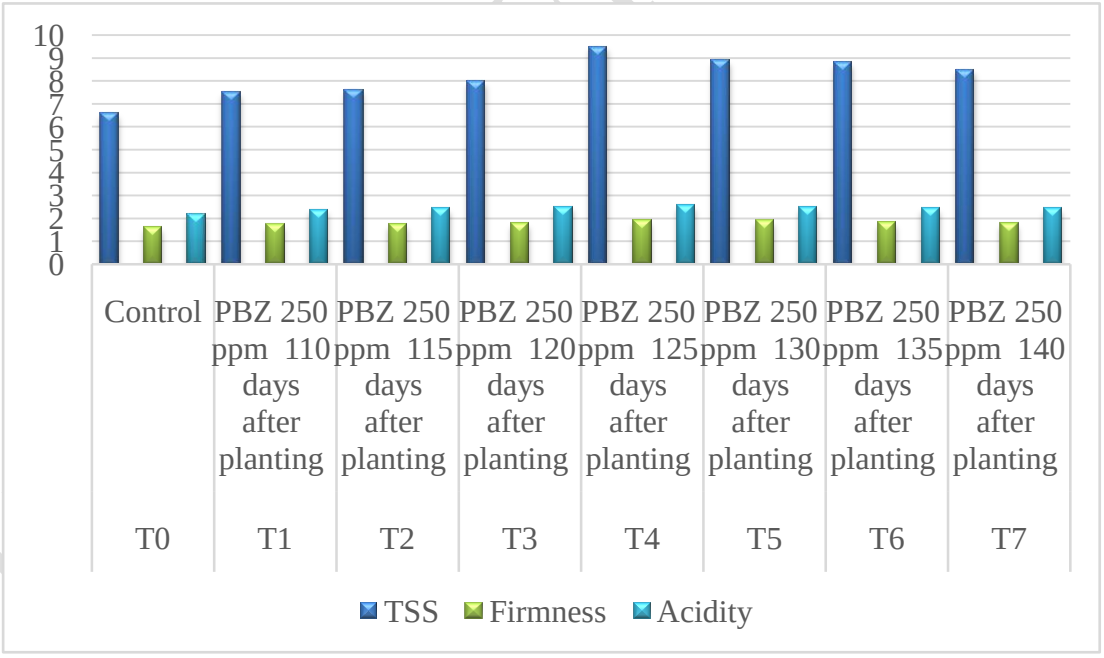

Fig2–TSS (°Brix),Firmness (N)andTitrableacidity(%).

V) TotalSolubleSolids: Thefindingsshowthatpaclobutrazolsprayingatvariousintervalssignificantlyaffectstheir TSS.ThetreatmentT4(PBZ250ppm)wasused125daysafter

planting to achieve the highest TSS (9.50 °Brix). However, from T0 (control), the lowest TSSwas seen. Statistics also shown that all treatments outperformed the control. Similar outcomeswereseen by **(Abolfaz*letal.*, 2012) [7].**

VI) Firmness: The findings demonstrate that spraying paclobutrazol at different intervals hasa significant influence on firmness. T4 (PBZ 250 ppm 125 days after planting) produced thehighest firmness (1.92 N), whereas T0 (control) produced the lowest firmness. Statistics alsorevealedthatalltreatmentsoutperformedthecontrol.Therewasnomeaningfuleffectdiscovered. Thesameresultswereobtained by **(GinéBordonabaandTerry,2009)[8].**

VII) Titrable Acidity: The results show a substantial effect of paclobutrazol spraying atdifferentintervalsontitrableacidity.ThetreatmentT4(PBZ250ppm,125daysafterplanting)showed the highest level of acidity (2.56%). The acidity of T0 (the control) was, however, theleast. All therapies outperformed the control, according to data. There was no discernibleimpact, it was discovered. The same outcomes were seen by **(GinéBordonaba and Terry,2009) [8].**

Conclusion

According to the preceding explanation, growth inhibitors have a typical impact on plantarchitecture intermsofyieldandqualitycontributingcharacteristicswhentakenat theappropriatetimeanddose.So,forthesubtropicalconditionofPunjab,farmersareadvisedthattheidealtimetoapplytheplantgrowthinhibitor paclobutrazol@250ppmamongthevariousspraytimingsis125daysafterplantingbecauseitproducedbetterfruitqualityandhighyield,whichwillfurther helpin improvingfarmers'profitability.

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UNDER PEER REVIEW

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