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The Effects of IBA, Rooting Media and Cutting Collection Time on Rooting of Kiwifruit

Der Einfluss von IBA, dem Bewurzelungsmedium und dem Versuchszeitraum auf die Bewurzelung von Kiwi

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Abstract

Hardwood cuttings of the kiwifruit cv. 'Hayward' were taken in January and February then treated with 2000, 4000 and 6000 ppm IBA to investigate rooting characteristics in perlite, peat, sawdust, peat + sawdust (1:1) and peat + perlite (1:1) media.

IBA application to stimulate the rooting gave good results in kiwifruit cv. 'Hayward'. According to results, 6000 ppm IBA application seem to be the best one the rooting for this cultivar. The highest rooting percentage obtained in peat + perlite and peat + sawdust media in both months. Higher rooting percentages were obtained when shoots were collected February rather than January.

The best media in terms of amount of larger pore size (>100 µm) providing aeration and drainage was sawdust, while amount of moisture retained low tensions (<0.33 atm) was peat + sawdust.

Zusammenfassung

Um die Bewurzelungseigenschaften in Perlite, Torf, Sägemehl, Torf + Sägemehl (1:1) sowie Torf + Perlite (1+1) zu untersuchen, wurden Hartholzstecklinge der Kiwisorte 'Hayward' in den Monaten Januar und Februar geschnitten und mit 2000, 4000 oder 6000 ppm IBA behandelt.

Die Stimulierung der Wurzelbildung durch die IBA-Behandlung erbrachte bei 'Hayward' gute Ergebnisse. Am besten schnitt in dieser Untersuchung die Behandlung mit 6000 ppm IBA ab. In beiden Monaten wurden die höchsten Bewurzelungsprozentsätze in Torf + Perlit sowie Torf + Sägemehl festgestellt. Im Februar geschnittene Stecklinge erbrachten höhere Bewurzelungsprozentsätze als im Januar geschnittene.

Das beste Substrat hinsichtlich Anzahl Poren mit größerem Durchmesser (>100 µm), die für gute Belüftung und Dränage sorgen, war Sägemehl sowie Torf + Sägemehl hinsichtlich des Wassergehalts.

Introduction

During recent years the cultivation of kiwifruit has expanded significantly in Turkey particularly in the Black Sea basin and it was even beginning to replace tea and hazelnut in this region in Turkey. On the other hand, interest in own-rooted kiwifruit plants has increased, especially some regions of Turkey where winter-damaged trunks can be re-placed more rapidly from adventitious shoots. The demand for these plants led nurserymen to look for effective means of propagating large number of plants rapidly.

The kiwifruit may be propagated by various methods such as grafting seedlings, stem cuttings, root cuttings and tissue culture (FLETCHER 1971; HARADA 1975). The production of kiwifruit more quickly and cheaply would be of considerable commercial value, and growing cuttings on their own roots could achieve this purpose by eliminating the need for rootstocks as well as for budding and grafting. Previous researches have shown that kiwifruit cuttings are characterized by a variable rooting ability (MANFROI et al. 1997; PANDEY 1997; RANA et al. 1999).

Bench heating, mist, temperature control, growth substances treatments are always required in order to obtain satisfactory results. IBA have been found critical both softwood and hardwood cuttings (BIASI et al. 1990). In addition to those, type of cuttings and collecting time have been reported strongly influence rooting (SIM and LAWES 1981; CALDWELL et al. 1988). On the other hand, the rooting media also can be affect on rooting of kiwifruit cuttings, but this factor has not been determined satisfactory level so far.

The aim of our work was the determination of the most suitable IBA concentrations, cutting time and rooting media on the rooting percentage, root length and root number of hardwood cuttings of kiwifruit cv. 'Hayward'.

Materials and Methods

Hardwood dormant cuttings of kiwifruit cv. 'Hayward' were prepared from vigorous shoots of 8-yr-old plants during January and February in 2001. The basal ends of the cuttings were dipped into IBA solutions at 0, 2000, 4000 and 6000 ppm for 5 seconds. After treatment, they were planted directly in different rooting media at 20 °C basal heat in mist propagation system in a heated

greenhouse. The rooting media compared in the trial were:

1 – Sawdust 2 – Peat + Sawdust (1:1 by volume)
3 – Peat 4 – Peat + Perlite (1:1 by volume)
5 – Perlite

Data on rooting percentage, number of roots per rooted cutting and root length were recorded after three months. The experimental design consisted of 4x5 treatments with four IBA doses and 5 media with four replicate including 15 cuttings each replicate.

The amount of moisture the media retained in different tensions (Pv) and pore size distribution (%) was determined on a pressure membrane (DEMIRALAY 1993).

Results

The amount of moisture (Pv) and pore size distribution (%) of media

The best medium in terms of higher moisture retain capacity at lower tensions (<0.33 atm) was peat + sawdust (60.0 %), which is followed by sawdust (58.0 %) and peat + perlite (57.0 %), respectively (Table 1).

Amount of larger pore size distribution (>100 µm) providing aeration and drainage is the highest in sawdust (55.7 %) medium and followed by peat (54.1 %) (Table 1).

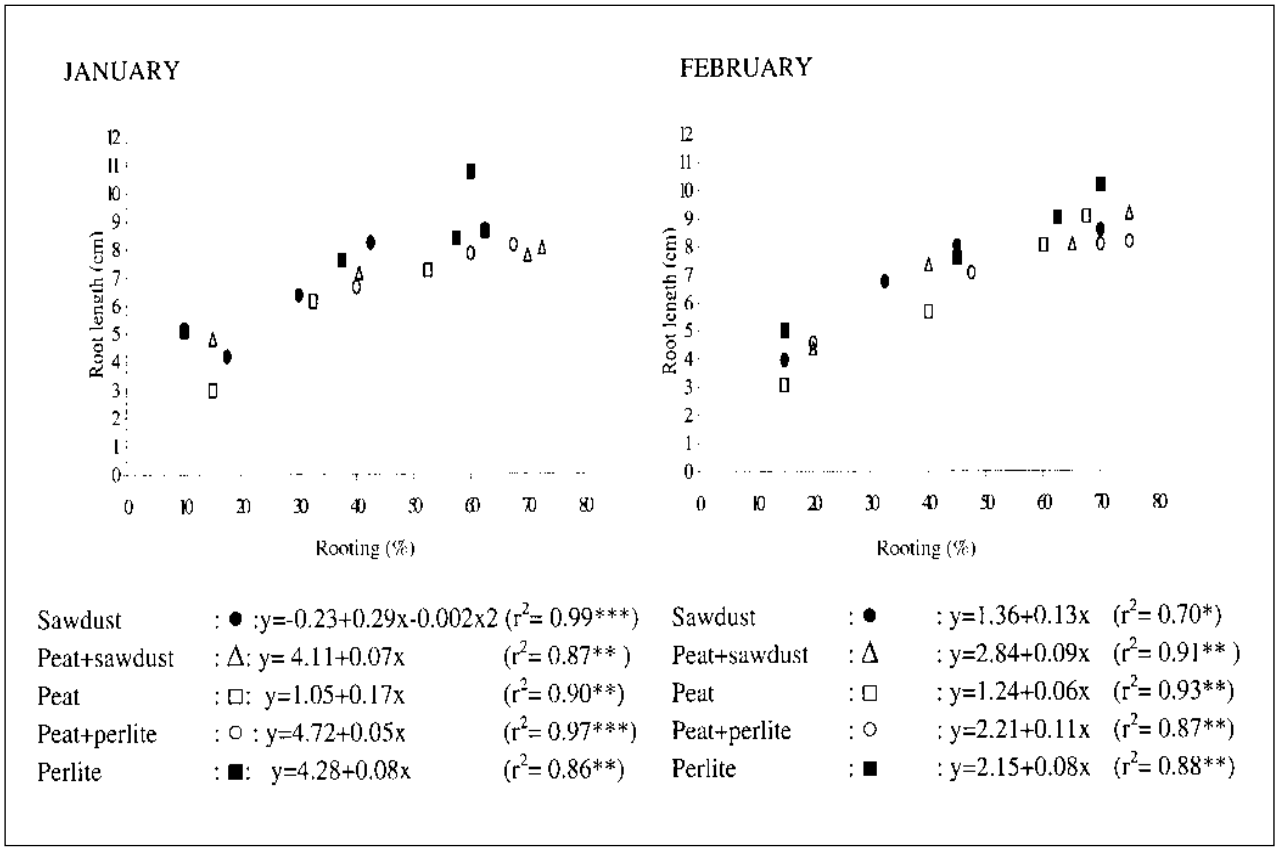


Figure 1. Relationship between rooting ratio (%) and root length of kiwifruits cv. 'Hayward' cuttings treated with IBA, using five types of media.
Beziehungen zwischen Bewurzelungsrate (%) und Wurzellänge bei IBA-behandelten Stecklingen der Kiwisorte 'Hayward' unter Verwendung von fünf Substratzusammensetzungen.

Table 1. The amount of moisture retained in different tensions (Pv) and pore size distribution (%) of substrates.
Zurückgehaltene Wassermengen bei unterschiedlichen Saugspannungen (Pv) und Porengrößenverteilung des Substrates.

Media	Moisture Tension (atm)				Pore size (µm)			
	0–0.01	0.01–0.1	0.1–0.33	0.33–15	>100	100–30	30–3	<3
Sawdust	54.5	2.7	0.8	7.1	55.7	1.5	4.6	21.0
Peat + Sawdust	51.5	5.5	3.0	10.5	54.1	2.9	8.5	19.1
Peat	39.1	8.5	3.7	12.3	44.6	3.0	11.9	19.7
Peat + Perlite	35.0	14.7	7.3	6.5	43.0	6.7	11.0	14.5
Perlite	31.3	16.8	5.6	3.5	40.8	7.3	7.5	14.0

Rooting percentages, root length and number of root per cutting

There were significant differences between rooting media and IBA doses with respect to rooting percentage (Table 2).

When compared with the control, treatment of cuttings with IBA enhanced rooting. Rooting was significantly higher in cuttings in peat + perlite and peat + sawdust media than the others ($p < 0.001$) both January and February. However, the lowest rooting percentage obtained from sawdust medium. For the most of media, the rooted cuttings increased with IBA concentration up to 6000 ppm.

Both rooting media and IBA concentrations significantly affected root length ($p < 0.01$) in both cutting collection time. Cuttings in perlite medium had longer roots than the others both January and February. IBA treated cuttings gave longer roots than control cuttings in all media types.

Rooting media and IBA concentrations statistically affected number of main roots per cuttings. More roots were produced by cuttings in peat + sawdust than the other media ($p < 0.01$). All IBA treated cuttings gave more roots than the controls ($p < 0.01$). 6000 ppm IBA being the best treatment in terms of number of main root per cutting for most of media (Table 2).

Table 2. The effect of media, IBA doses and cutting collection time on rooting, root length and number of main root per cutting of kiwifruit cv. 'Hayward'.
Die Wirkungen von Substrat, IBA-Konzentration und Schnitttermin auf die Bewurzelung, die Wurzellänge und die Anzahl Hauptwurzeln pro Steckling bei der Kiwisorte 'Hayward'.

		JANUARY			FEBRUARY		
Media	IBA Conc. (ppm)	Rooting (%)	Root Length (cm)	Root Number	Rooting (%)	Root Length (cm)	Root Number
Sawdust	0	17.50	4.20	3.16	15.00	3.96	3.00
	2000	30.00	6.36	4.68	32.50	6.73	5.13
	4000	42.50	8.23	4.82	45.00	8.00	5.39
	6000	62.50	8.67	5.16	70.00	8.55	5.00
Peat + Sawdust	0	15.00	4.83	4.00	20.00	4.39	4.26
	2000	40.50	7.16	6.33	40.00	7.35	6.13
	4000	70.00	7.78	8.24	65.00	8.06	8.38
	6000	72.50	8.04	8.86	75.00	9.16	8.02
Peat	0	15.00	3.00	2.00	15.00	3.08	3.00
	2000	32.50	6.16	4.14	40.00	5.66	4.57
	4000	52.50	7.24	4.99	60.00	8.01	5.15
	6000	62.50	8.61	6.68	67.50	9.04	7.07
Peat + Perlite	0	10.00	5.17	3.15	20.00	4.56	4.32
	2000	40.00	6.65	5.17	47.50	7.04	4.83
	4000	60.00	7.82	6.18	70.00	8.04	7.01
	6000	67.50	8.14	7.45	75.00	8.14	8.06
Perlite	0	10.00	5.10	3.11	15.00	5.00	3.00
	2000	37.50	7.60	4.68	45.00	7.57	5.67
	4000	57.50	8.36	6.80	62.50	9.00	7.15
	6000	60.00	10.74	6.86	70.00	10.15	7.75
SED (Media)		9.14***	0.67***	0.50**	7.67***	0.83**	0.66**
SED (IBA)		7.44***	1.10**	0.96**	8.33**	0.98**	0.90*
SED (Media x IBA)		NS	NS	NS	NS	NS	NS

*$p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; NS: Non significant

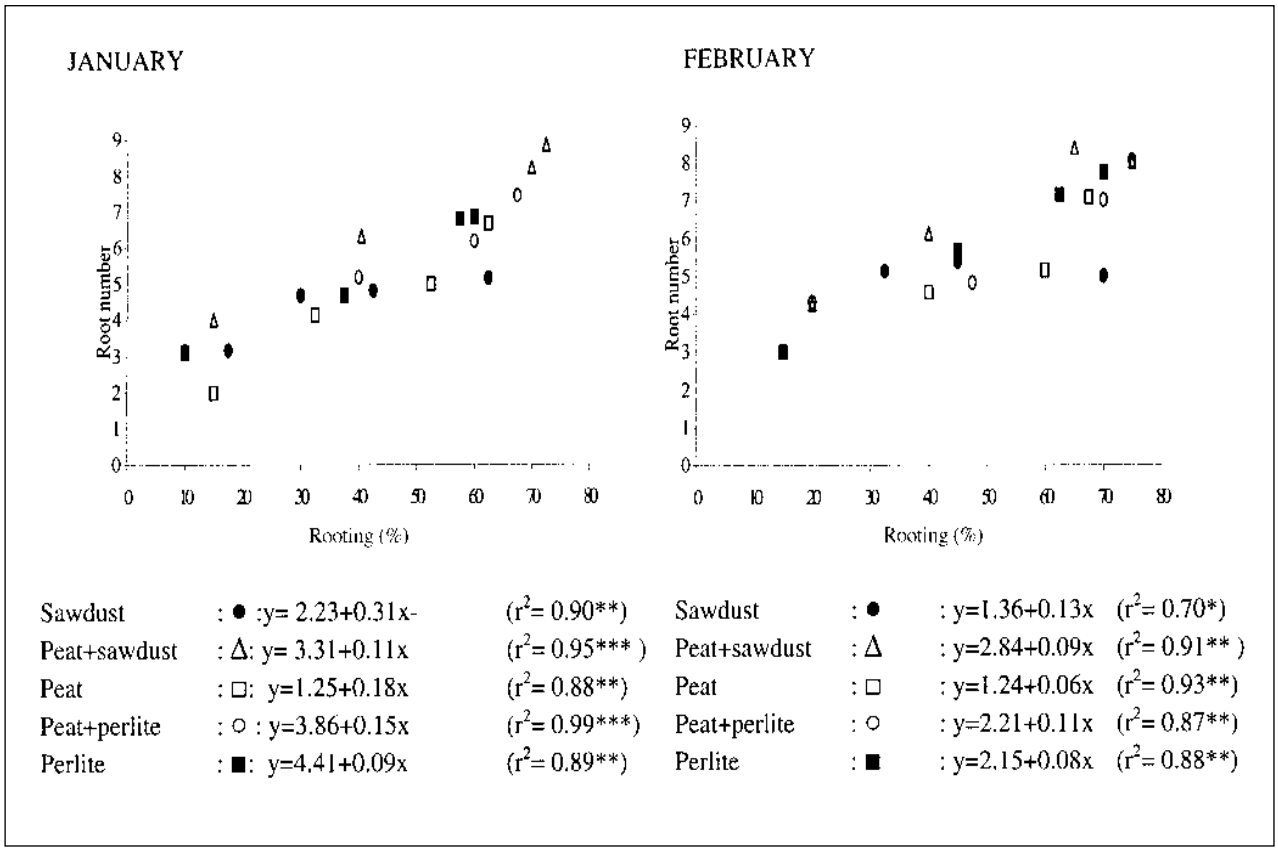


Figure 2. Relationship between rooting ratio (%) and root number of kiwifruit cv. 'Hayward' cuttings treated with IBA, using five types of media.
Beziehungen zwischen Bewurzelungsrate (%) und Wurzellänge bei IBA-behandelten Stecklingen der Kiwisorte 'Hayward' unter Verwendung von fünf Substratzusammensetzungen.

Discussion

The results obtained in this study indicated that rooting percentage, root length and number of main roots per cuttings were significantly affected by rooting media and IBA doses in both cutting collection time. Control cuttings rooted poorly and rooting percentage increased until the level of 6000 ppm IBA doses, suggesting that IBA doses may be important for the rooting performance of this kiwifruit cultivar. These results indicated that IBA concentration of 2000 ppm was low for rooting of this kiwifruit cultivar. CALDWELL et al. (1988) and RANA et al. (1999) recommended concentration of IBA for hardwood cuttings of kiwifruit were between 4000–8000 ppm.

One of the most important criteria for the successful rooting of cuttings is suitable rooting medium (MACDONALD 1986; ERCİŞLİ et al. 2001)). Variable results were observed between the cuttings of kiwifruit cv. 'Hayward' in different media. Both rooting ratio and root number increased because of increasing water retention capacity of media at low tensions (<0.33 atm) (Table 1). Rooting percentage and number of main roots per cutting were the highest in peat + sawdust and peat + perlite media, respectively. This may imply that those media had better water retention properties. According to GRANGE and LOACH (1983), water uptake by cuttings is indirectly proportional to the water content of the medium, as determined by its water retention and aeration properties (MACDONALD 1986). The interaction between the rooting medium and auxin treatment could effect rooting response, since increased water uptake could be expected to increase auxin uptake (ELLYARD and OLLERENSHAW 1984). On the other hand, root length were the highest in perlite media. This may also imply that this media had better aeration properties because of its larger pore size properties (>30 µm) (Table 1).

In conclusion, the application of IBA at a concentration of 6000 ppm seemed to be the best application for rooting of hardwood cuttings of kiwifruit cv. 'Hayward'. There was variation among the different media in terms of rooting percentage. Peat + sawdust and peat + perlite were founded more suitable for rooting for this kiwifruit cultivar. However, apart from IBA and rooting media, other factors such as temperature of rooting media, cutting type should be taken in consideration.

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