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EFFECTS OF PHOTOSELECTIVE COLOUR NETS ON THE VEGETATIVE,
PRODUCTIVE, AND QUALITATIVE BEHAVIOUR OF KIWIFRUIT, JINTAO
CULTIVAR

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Abstract

BACKGROUND: In the Mediterranean basin, the solar radiation received is very high for many tree species over several hours of the day during the summer. Using a photosensitive net can improve the climatic conditions and also modify the quality of light received.

OBJECTIVE: This study aimed to evaluate the influence of the colour of photosensitive nets on the yield and quality of *Actinidia chinensis*.

MATERIALS: The experiment was carried out in Southern Italy on an orchard of Jintao kiwifruit. Photosensitive nets of different colours were used: black, red, yellow, white, and grey. The resulting fruits were compared to those of plants in the open field. A randomised block design was adopted. Environmental, vegetative, and leaf gas exchange parameters; yield; and fruit quality were defined. All data were analysed using the Variance Analysis (ANOVA) and the Principal Component Analysis (PCA).

RESULTS: Photosensitivity influenced production. The best results were obtained under the red net in terms of production and fertility indices. Fruit size, maturation indices, and nutraceutical parameters were also higher under the red net. Among the nets, the grey net induced the worst tree productivity results and the worst fruit quality parameters. However, all nets showed better results compared to the open field.

28 CONCLUSION: The photosensitive net strongly influenced the yield and quality of Jintao
29 kiwifruit and the better results compared to the open field. The red net proved to be the best
30 performer for the environment where the experiment was carried out.

31
32 **Keywords:** *Actinidia chinensis*, maturation indices, photosensitive net.

33

34 **Introduction**

35 Italy holds the leadership in Europe and in the northern hemisphere of the Planet for the
36 production of kiwi fruit. The production of 315,000 T is distributed over 25,000 h [1].

37 The productivity of *Actinidia* spp. and the sensory and nutritional quality of their fruit are
38 determined through interactions between different factors. These include a tree training system,
39 cultivar, rootstocks, management of the soil that hosts the root system, and the canopy [2] [3]
40 [4]. With regard to the latter aspect, the yield of well-cultivated trees depends on optimal light
41 interception to each part of the canopy structure, realised through pruning [5]. This effect is
42 important because photosynthetic carbon fixation is a function of the sunlight captured by a tree
43 or an orchard. Changes in fruit quality are often caused by the uneven distribution of light to
44 the canopy [6] [7] and the light quality; for example, red light (600–700 nm) increases
45 anthocyanin synthesis in the fruit [8]. Excess of photosynthetic flow density (PPFD) can lead
46 to photo-inhibition of the photosynthetic apparatus. It is a phenomenon that, in the long term,
47 causes efficiency depression of the photosynthesis process [9], and it can worsen under stressful
48 conditions induced by a water deficit and/or high temperature. The light saturation point of
49 kiwifruit corresponds to 960 $\mu\text{mol (photon) m}^{-2} \text{ s}^{-1}$ light [10].

50 Southern Italy plays a decisive role in Italian production, thanks to its optimal soil and climate
51 conditions and the mild autumn climate. The net protects the fruit tree canopy from adverse
52 environmental conditions such as hail and wind. Moreover, some species have a low light
53 saturation point. Therefore, the net creates more favourable climate conditions for plant
54 physiology. With its shading function, it protects the leaves from the adverse effects induced
55 by the excess of PPFD [11] [12] [13].

56 Furthermore, the photoselective net acts as a spectral filter (with differential light scattering
57 properties), absorbing various spectral bands and modifying the light quality and then the ratio
58 among the same spectral bands, such as the red/far-red (R/FR) ratio [14]. This effect also
59 depends on the material of the net.

60 In recent years, nets have been used indirectly to increase yield and fruit quality in some
61 Mediterranean countries. Indeed, many studies have been carried out to evaluate the effect of
62 photoselective nets on fruit trees [15] [16] [17] [18] and ortive plants [19] [20] [21].

63 This study aimed to evaluate the influence of the photoselective hail net and its colour on several
64 parameters of Jintao kiwifruit. Therefore, many parameters of the tree and the fruit were
65 detected to determine the best colour of the photoselective net for the area under study, which
66 is an important kiwifruit cultivation area of southern Italy.

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1. Materials and Methods

1.1 Orchard

The experiment was carried out during two cultivation cycles (2017-2018) on the Femia farm, located in Cittanova (RC), Calabria, Italy (38° 29' N; 15° 58' E). Jintao trees were planted in the spring of 2014 in sandy soil, with pH 6.8 (sub-acid), 2.1% organic matter, and 1.5 g kg⁻¹ nitrogen content. The vines were spaced 5 m × 2.5 m apart (800 vines ha⁻¹), and north to south row orientation was adopted. Jintao is a yellow-fleshed tetraploid genotype (2n = 4x = 116) of *A. chinensis*. It was selected at the Wuhan Institute of Botany (WIB) [22]. It has a low cooling demand (approximately 350-450 hours), which is why it is well adapted to the Mediterranean climate with a mild winter, producing high-quality fruit. The male tree of the *Belén* cultivar was planted using a male/female ratio of 1:8.

The trees were trained in a pergola system. The cane was pruned to 1.4 m, and ten canes per plant were left. The yearly dormant pruning (December) was combined with summer pruning (July).

The orchard was managed using standard integrated pest control systems and stable drip irrigation and fertilisation systems.

The same amount of water irrigation and fertilisation per plant was used for all treatments, for comparison. Full bloom occurred during the last week of March in both years (25 March, 2017; 27 March, 2018), and fruits were thinned at the end of May. In this area, the conventional harvest time is approximately 180 Days After Flower Bloom (DAFB) (31 October, 2017; 1 November, 2018).

1.2 Treatment and experimental design

Photoselective hail nets of five different colours were used: black (BK), red (RD), yellow (YL), white (WH), and grey (GR) (the main characteristics are shown in Table 1). The resulting fruits were compared with those of trees grown in the open field (OF).

A total of 54 trees, three blocks with three plants per treatment, were arranged in a randomised design.

1.3 Measurements

1.31 PPFD, UV radiation, and temperature.

101 PPFD, UV radiation, and temperature were measured at midday (12:00) during sunny days
102 using a PAR sensor (Mod. 3668I; Spectrum Technologies Inc., Aurora, Illinois, USA), UV
103 sensors (Mod. 3676I; Spectrum Technologies Inc., Aurora, Illinois, USA), and thermocouple
104 sensors (GMR Instruments, Florence, Italy, UE), respectively. These sensors were placed below
105 the nets in the open field, and they were linked to a datalogger whatchdog 1000 (Spectrum
106 Technologies Inc., Aurora, Illinois, USA).

108 *Light quality*

109 The PAR spectrum light was measured at midday (12:00) using a spectroradiometer (PS-300;
110 Apogee Instruments Inc., Logan, Utah, USA) in the open field and under the nets.

112 *Shoot and fertility indices*

113 The shoot length (SL) was measured of all shoots distributed along with four canes randomly
114 chosen per selected tree. Moreover, the vegetative shoot, mixed shoot, number of fruits per
115 mixed shoot, and unbroken buds were detected. After harvesting the plants were defoliated. The
116 leaf area per plant was measured using a leaf area meter (Li-Cor 3100; LI-COR Biosciences,
117 Lincoln, Nebraska, USA) and the leaf area index (LAI) was calculated; It is was obtained
118 dividing the leaf area of the plant by the soil area occupied by a plant. The fertility index (FI =
119 number of flowers/number of fertile buds) and real fertility (RF = number of flowers/number
120 of buds left after pruning) were calculated [23] [24].

122 *Gas exchange and fluorescence*

123 Leaf net assimilation of CO₂ (A_n), stomatal conductance (g_s), and internal CO₂ concentration
124 (C_i) were measured on 54 mature leaves from the outer layer of each tree (6 leaves × 3 plants
125 × 3 blocks). The measurements were taken using a portable photosynthesis system (Li-Cor
126 6400XT; LI-COR Biosciences, Lincoln, Nebraska, USA).

127 The gas exchange measurements were carried out during clear sunny summer days (from 11:00
128 to 13:00) during the last week of the summer months (June, July, and August) in both years.
129 The carboxylation efficiency (P_n/C_i) was also calculated.

130 Photoinhibition was also estimated using a chlorophyll fluorometer (Li-Cor 6400-40; LI-COR
131 Biosciences, Lincoln, Nebraska, USA). The measurements were taken after 30 min of dark
132 adaptation (from 11:30 to 12:30) by using leaf clips from the same leaves used for the gas
133 exchange measurements. Therefore, the leaves were detached, washed with distilled water, and

the SPAD index was measured using SPAD 502 (Spectrum Technologies Inc., Aurora, Illinois, USA).

1.4 Maturation indices and nutraceutical parameters

Fruits were collected and analysed to 180 DAFB (31 October, 2017; 1 November, 2018). Eight fruits were randomly collected from the canopy of the six vines per treatment (4 fruits $\times$ 6 trees $\times$ 3 blocks = 54 fruits). They were immediately used to determine: transversal (D) and longitudinal diameter (H) by using a precision calibre; fresh weight (FW) by using an electronic balance (Mettler-Toledo, Greifensee, Switzerland) and have been divided into 4 weight classes (< 80 g; 81-90 g; 91-100 g; 101-110 g); flesh firmness (FF) by using a digital penetrometer with an 8 mm probe (PCE 100, Padova, Italy) on the equatorial zone of the fruit, on two opposite sides; the pulp colour by using a Minolta spectrophotometer CM-700d (Minolta, Inc., Tokyo, Japan), in terms of CIELab and HSB colour spaces; total soluble solids content (TSS) as °Brix, by using a digital refractometer (PAL-1, Atago, Tokyo, Japan) on juice drops obtained by squeezing the apex and the base of every fruit; and titratable acidity (TA) by titrating 10 mL of the juice diluted with distilled water (1:1) with 0.1 N NaOH to pH 8.2. Titration results were expressed as citric acid %. Dry matter content (DMC) was determined using a standardised sampling method: a horizontal slice of fruit tissue from the equatorial zone was extracted from each fruit. The thickness of the slice was approximately 1 cm, and the fresh weight (FW) was recorded. The slice was placed in a dehydrator at 70 °C until a constant dry weight was reached. DMC was expressed as a percentage of FW.

The ascorbic acid content was determined using the procedure based on the reduction of 2,6-dichlorophenol-indophenol (DIP) by ascorbic acid. For each fruit, fresh pulp tissue (3 g) was mixed with 20 mL (3%) metaphosphoric acid and homogenised. Ascorbic acid content was determined by titration of 15 mL filtrated juices with DIP containing sodium bicarbonate. The ascorbic acid content was expressed as mg ascorbic acid 100 g⁻¹ FW.

To determine Total Polyphenols Content (TPC) and Total Antioxidant Capacity (TAC), the pulp of the sample was homogenised using an Ultraturrax blender (20.000 rpm, T25 Basic; IKA, Werke, Germany, UE). The TPC and TAC were separately analysed using a Lambda 35 spectrophotometer (PerkinElmer Corporation, Waltham, MA, USA). Before measuring the TPC and TAC, standard curves were prepared for each test. TPC (mg gallic acid equivalents g⁻¹ FW) was determined using the Folin–Ciocalteu method [25]. The TAC was determined using

the modified TEAC assay and expressed as mmol Trolox equivalents g⁻¹ FW [26] [27]. The TEAC assay included both the hydrophilic and lipophilic contributions of the samples [28]. The fruits after being weighed have been divided into 4 weight classes (< 80 g; 81-90 g; 91-100 g; 101-110 g). the fruits

1.4 Statistical analysis

All data were subjected to variance analysis tests (ANOVA), and the means were compared using Tukey's test when the ANOVA indicated significant ($P < 0.05$) variable effects. All data are reported as means from both years.

All data analyses were performed using IBM® SPSS® Statistic, version 22 (SPSS Inc. IBM Company, Armonk, NY, USA). The variables were then used in a principal component analysis (PCA) to evaluate more complex relationships between parameters and to identify how they were related to the colour of the photoselective net.

2. Results and discussion

Our results show that the photoselective nets affected the intensity, light quality, and effective heat, according to other authors [29].

PPFD, UV, and temperature

All photoselective nets decreased PPFD, UV, and temperature by approximately 19%, 22%, and 15% compared to the open field, respectively. Among the nets, the differences in terms of colour were not significant for PPFD (Table 2), whereas UV was significantly lower under the RD net (Table 2). Among the nets, the temperature recorded ranged from 26.79 °C to 28.47 °C; the higher temperature was recorded under GR net, whereas the lower value was recorded under the RD net. However, the highest values (PPFD, UV-b, and Temperature) were observed in the OF. For the PPFD, UV, and Temperature, a significant change was observed between the two years, whereas the Years (Y) × Treatments (T) interaction was not significant.

Light quality

Regarding the light quality, the blue light (BL) was higher under the BK net as compared to the other coloured nets and was statistically similar to that of the OF (Table 3). These results are in agreement with those of other authors [29] [30]. Under the RD and YL nets, the red light (RL)

202 and irradiated light (FR L) were similar to that of the OF and were higher compared to those of
203 the other colour nets (Figure 1, Table 3).

204 However, the R/FR ratio did not change among treatments (Table 3).

205

206 *Shoot, fertility indices, and LAI*

207 The difference in shoot length among the treatments was attributable to differences in internode
208 development (data not shown) (Table 4). It has been demonstrated that increasing the BL (Blue
209 Light) fraction decreases cell expansion and inhibits stem elongation [31]. It has reduced
210 internode elongation in agreement with that reported by other authors [32]. The FR deficient
211 environment has also been shown to reduce the stem elongation growth of many different plant
212 species [33] [34] [35] [36] [37]. In our experiment, these two conditions were observed under
213 the BK net (Tables 3, 4); however, the deficiency of FR light was not solely responsible for
214 reducing shoot length as observed under the GR net (Tables 3,4). When BL (Blue Light) was
215 not higher, the shoot length was negatively correlated with RL (Table 3). Indeed, the shoot
216 length was higher under the GR and WH nets. The Leaf Area Index (LAI) ranged from 2.15 to
217 2.59, and it did not change between treatments (Table 3). All parameters reported in Table 4
218 changed by year, whereas the $Y \times T$ interaction was not significant (Table 4).

219 It has been shown that the R/FR ratio influences flower differentiation, but in our experiments,
220 R/FR did not change with the treatments (Table 2). However, fertility indices were influenced
221 by the amount of R and FR light. Indeed, a strong correlation between FI with RL and between
222 FR light with RF was found (Figures 2 and 3). These indices were higher under the RD, YL,
223 and under the OF conditions, where R and FR light were higher (Tables 3, 4). The fertility
224 indices influenced the fruit load of the plant, which was decidedly lower under the BK and GR
225 nets compared to the other treatments (see Table 8). The percentage of flower shoots was lower
226 under the BK net, whereas no significant differences were observed among the other treatments
227 (Table 4).

228

229 *Gas exchange and fluorescence*

230

231 Photosynthesis (Pn) was higher under the RD net than under the other treatments. Under the
232 GR net, the lowest value of photosynthesis was recorded, though it was still higher than that of
233 the OF. The gs did not vary among the nets, whereas it was significantly lower in the OF (Table
234 5).

235 Carboxylation efficiency (P_n/C_i) is an estimate of Rubisco activity [38]. A higher C_i associated
236 with a lower g_s causes a decrease in the P_n/C_i ratio [39] [40]. Therefore, the trees under the RD
237 nets showed better P_n/C_i performances, whereas the worst performances were observed in the
238 OF and under the GR nets (Table 5).

239 F_v/F_m , and $\Phi PSII$ fluorescence parameters were significantly higher under the RD, BK, and
240 YL nets than under the GR nets. The higher values suggest a lower risk of photo-inhibition and
241 photooxidation for the photosystem apparatus of the leaf. Under nets the lowest values were
242 recorded in the GR nets, whereas among treatments the lowest values were observed in the OF.
243 The F_v/F_m ratio under the BK and RD nets was similar to that reported by other authors [41]
244 for well-irrigated kiwifruit during midday, although in another cultivar. The tree behaviour
245 under the WH nets was better to that under the GR nets (Table 6). The other fluorescence
246 parameters as qP and ETR were higher under the red net, followed by BK, YL, and WH nets,
247 whereas the worst results were detected under GR net and the OF (Table 6). Therefore, all
248 photosensitive nets evidently improved the above-mentioned fluorescence parameters than that
249 to the OF.

250

251 *Maturation indices and nutraceutical parameters*

252

253 The average fruit FW was significantly lower under the GR netting than under the RD nets
254 (Table 7), but it was within the acceptable range of values reported for the Jintao cultivar. Under
255 the GR net, the average FW observed in our study was lower than that reported by other authors
256 [22] [42].

257 Under the other three nets (YL, WH, and BK), the fruit FW was not significantly different from
258 that recorded under the RD and GR nets. The lowest values were recorded in the OF.

259 Quality differences between the fruits were determined in terms of size classes. Huang reports
260 that fruit size of Jintao kiwifruit is 90 g [22]. The percentage of fruit belonging to the size class
261 from 90 to 110 g was higher under the RD and BK nets (70% and 61%, respectively) (Figure
262 4).

263 Under the BK net, a similar FW to that under the RD nets was observed, which can be attributed
264 to the very low fruit load recorded under the BK net (Table 7). This condition reduced
265 competition among the fruit (sink); The low load was also observed under the GR net, but the
266 fresh weight was lower (Table 8) because under the GR net, the photosynthetic rate was also
267 very low (Table 5).

268 Regarding the other physiological parameters, the fruit was also 5% thinner under the GR net
269 than under the alternative treatments (Table 7), whereas no differences were observed in fruit

height among the treatments (Table 7). Therefore, the fruit shape, as shown by the H/L ratio, was significantly different among the treatments. Indeed, the H/L ratio was significantly higher under the GR nets, whereas it was lower under the YL and WH nets and the OF. No significant differences were observed under the BK and RD nets, compared to the other coloured nets, for this parameter (Table 7). Under the GR net and the OF, lower yields per plant were recorded (37.65 and 38. kg plant⁻¹, respectively) (Table 8) than the other treatments. However, the yield tree⁻¹ was similar to that reported by other authors [35]. Under the WH nets, the yield was significantly higher than that under the BK and GR nets, but it was significantly lower than that under the YL and RD nets. The highest yield per plant was recorded under the latter two net colours, and the differences were not significant between them (Table 8). In the OF, the yield per tree was similar to that obtained from under the GR nets (Table 8). No interaction Year x Treatments was observed, whereas the significant differences were observed between years.

Maturation indices

With regard to the colour parameters, Lightness (L*) was lowest under the GR net and highest under the WH nets (Table 9). No differences were observed between the RD and YL nets compared to the OF and the BK and WH nets.

Under the RD net, the pulp tint showed a greater shade of red and a lesser shade of green (i.e., a* and b* chromatic components were higher; Table 9). However, the main colourimetric parameter used as the maturation index is the Hue angle. This parameter is lower under 103 °Hue [22] at harvest time. In our experiment, it was higher than 103 °Hue in the OF, whereas it was lower under all net colours used. However, it was lower under the RD nets than under the other treatments (Table 9). No significant difference was observed in chroma (Table 9).

In the area where the experiment was carried out, harvesting occurred when the dry matter exceeded 16% and the colouration of the pulp reached at least 103° Hue (Table 9). Harvesting generally took place between 30 October and 2 November; therefore, Jintao was harvested ten days before the green kiwifruit, Hayward cultivar.

The firmness of the pulp was significantly higher in the fruit of the trees grown under the RD net than of those grown under the other nets, whereas the lowest values were detected under the GR net (Table 10). No differences were observed between the fruits grown under the YL, BK; they were significantly lower and higher in firmness, respectively, than those grown under the RD net, and GR net (Table 10). In the open field and under WH, the firmness pulp value was similar to GR, BK, and YL nets. All firmness values recorded were higher than those reported by other authors [22] [42] for the Jintao cultivar.

DMC was significantly higher in the fruit of trees under the RD nets than in the fruit of those grown under all other nets, whereas the dry matter was significantly lower in fruit from trees under the GR nets than in those grown under other nets. No differences were observed between fruit from trees under the BK, YL, and WH nets, for this parameter. However, the lowest value was recorded in the OF (Table 10).

Regarding the TSS, the value was significantly higher in fruit from trees under the RD nets than from those under the other colour nets; the TSS was also significantly higher in fruit from trees under the BK and YL nets than from those under the GR nets and the OF, whereas the lowest value was observed in fruit from trees under the OF. No differences were observed between the WH and GR, BK, and YL nets for this index (Table 10). The TSS reached the value reported by other authors [22] only under the RD nets.

TA was highest in fruit from trees under the RD nets compared to other colour nets, but it was lower than that reported by other authors [22]. TA was significantly higher in fruit from trees under the BK nets than under GR nets and the OF, whereas no differences were observed among the YL, WH nets and GR, BK nets and the OF (Table 10).

The TSS/TA was significantly higher in fruit from trees under the RD and YL nets than under the other coloured nets. The lowest value was detected in the OF (Table 10).

No interaction $Y \times T$ was observed; the firmness pulp and DMC were similar between years, whereas changes were observed for the other parameters (Table 10).

Nutraceutical parameters

Total antioxidant capacity (TAC) was significantly higher in fruit from trees under the RD, BK, and YL nets and in the OF compared to the other treatments (Table 11). The total polyphenol content (TPH) was higher in fruit from trees under the RD and WH nets compared in those under BK, whereas no difference was observed among the YL and GR nets and the OF compared to the other treatments. Moreover, the flavonoid content was higher in fruit from trees under the WH nets and lowest in fruit from trees under the GR nets and the OF, whereas intermediate values were detected under the BK, RD, and YL nets. The carotenoid content was highest in fruit from trees under the YL nets, whereas lower values were detected under the BK and RD nets. However, lower chlorophyll content was observed in plants from trees under the BK and RD treatments than under the other treatments. The lower chlorophyll content in RD and BK nets contributed to faster colouration of pulp, whereas in the fruit from trees under YL nets the faster yellow colouration of the pulp can be attributed to a higher carotenoids content (Tables 9,11).

339 The AA content was higher in the fruit from trees under the BK, RD, and YL nets than under
340 the WH and GR nets and the OF (Table 11).

341 Regarding the nutraceutical aspect, better performance was also recorded in the fruit from trees
342 under the RD nets.

343

344 PCA

345 All variables of the PCA were projected in the F1-F2 and F3-F4 planes (Figure 5). In this way,
346 we could analyse the relationships between variables and the formation of factors.

347 Factors F1 and F2 of the PCA accumulated 45.93 and 20.64% of the variance (Figure 5),
348 whereas F3 and F4 accumulated 15.50 and 10.15%, respectively (Figure 5). They totalled
349 92.22% of the initial variability. Almost all the parameters were uniformly distributed in all
350 quadrants (Figures 5,6). The correlations between variables and factors are reported in Table
351 12.

352 In particular, a first group consisting of to gas exchange variables, Pn, Pn/Ci, three fruit
353 biometric variables, FW, height, diameter, four maturation indices (Fir, DMC, TA, a*), all
354 fluorescence parameters, Fv/Fm, Φ PSII, qP, and ETR, one fertility variable, F.I., and two
355 nutraceutical variables, AA, FT contributed to F1 factor formation (Table 12).

356 These variables were positively correlated among them and were distributed on the right side
357 of F1-F2 plane. The H/L, °H, Car, Ci, and T°, variables were distributed on the left side of F1-
358 F2 plane; they were strongly correlated among them and negatively correlated with the first
359 group of variables. This second group also participated in F1 factor formation (Table 12)

360 The Yield, TPH, gs, R.F., SL, MS, and R/FR vectors were correlated among them and placed
361 in the upper side of F1-F2 plane, whereas BL vector was placed in the lower side of F1-F2
362 plane. They contributed to the formation of the F2 factor (Table 12).

363 The b*, TSS, TSS/TA, TAC, RL, FRL, LAI variables contributed to the formation of F3 factor
364 (Table 12). The LAI vector was located on the left side, whereas the other variables in the right
365 side of F3-F4 plane. Chr and Chl variables were places in the lower and upper side of F3-F4
366 plane, respectively, and contributed to the formation of F4 factor (Table 12).

367 The results of the PCA can be explained by the positioning of the relative parameters observed
368 and the centroids (Figure 6).

369 The centroid represents the resulting coordinates of the PCA. The RD centroid was placed on
370 the right side of the F1-F2 biplot on the F1 factor axis (Figure 7). Its position was positively
371 correlated with a*, FW, H, D, Fir, DMC, TA, FT, AA, Pn, Pn/Ci, F.I., Fv/Fm, Φ PSII, qP, ETR

372 vectors. Moreover, RD was negatively correlated with the °H, i.e., a better colouration of the
373 pulp, H/D, Car, Ci, T°.

374 The OF centroid was also correlated with F1, but it was placed on the left side. Therefore, the
375 OF showed opposite values compared to the RD nets.

376 The WH centroid was near to Yield, TPH, gs, R.F., MS, SL, and R/FR vectors, and was
377 positively correlated with them. The BK centroid was positively correlated with BL(Blue light).

378 The GR centroid was correlated with the F3 factor and was placed on the left side (Figure 8).
379 Therefore, it showed lower values for b*, TSS, TSS/TA, TAC, RL, FRL. Finally, the YL was
380 correlated with F4 (Figure 8). The YL was placed in the upper right side, near the Chr vector.

381

382 **4. Conclusion**

383 The photoselective nets influenced the production of *A. chinensis* cv Jintao in Southern Italy.
384 Aside from the fundamental role of the nets in the protection of the plants from hail. The net
385 improves the results compared to the OF or gives similar results, in the environment where the
386 experiment took place. The overall evaluation of all the parameters analysed showed that every
387 color influences tree performances. However, only the red net positively acts on a greatest
388 number of parameters considered very important for the production of kiwi fruit, such as fruit
389 weight, pulp colour, dry matter, total soluble solids, ascorbic acid content, photosynthetic
390 performance of the plant, and response to fluorescence parameters. The YL and WH nets follow
391 the RD net; they give good results compared to the open field, whereas the GR and BK nets
392 give the worst about to yield per tree and per hectare compared to other color nets; their
393 performances were similar for some aspects to the open field.

394

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396

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399

400 **Conflict of Interest**

401

402 The authors have no conflict of interest to report.

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406 **References**

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408 [1] Balestra GM, Costa G. La situazione in Italia: evoluzione varietale sì ma con tante avversità.
409 Rivista di frutticoltura e ortofloricoltura. 2020;7:10-16.

410

411 [2] Inglese P, G. Gullo G, L.S. Pace LS, G. Ronzello G. Fruit growth, oil accumulation and
412 ripening of the olive cultivar Carolea in relation to fruit density. Acta Hort. 1999;474:265–8.

413

- [3] Gullo G, Branca V, Dattola Ag, Zappia R, Inglese P. Effect of summer pruning on some fruit quality traits in Hayward kiwifruit. *Fruits*. 2013;68(4):315–22.
- [4] Gullo G, Dattola A, Liguori G, Vonella V, Zappia R, Inglese P. Evaluation of fruit quality and antioxidant activity of kiwifruit during ripening and after storage. *J Berry Res*. 2016;6(1):25-35.
- [5] Palmer JW. Canopy manipulation for optimum utilization of light. In: Wright CJ, editor. *Manipulation of fruiting*. 47th Nottingham Easter School. London, Butterworths. 1989. p. 245-262.
- [6] Robinson TL, Lakso AN, Ren ZB. Modifying apple tree canopies for improved production efficiency. *HortScience* 1991;26:1005–12.
- [7] Tustin DS, Hirst PM, Warrington IJ. Influence of orientation and position of fruiting laterals on canopy light penetration, yield, and fruit quality of ‘Granny Smith’ apple. *J Am Soc Hort Sci*. 1988;113:693–99.
- [8] Bastías RM, L. Corelligrappadelli L. Light quality management in fruit orchards: Physiological and technological aspects. *Chil J of Agric Res*. 2012;72(4):574-81.
- [9] Walters RG, Horton P. Theoretical assessment of alternative mechanisms for non-photochemical quenching of PSII fluorescence in barley leaves. *Photosynth Res*. 1993;36:119-39.
- [10] Greer DH, Halligan EA. Photosynthetic and fluorescence light responses for kiwifruit (*Actinidia deliciosa*) leaves at different stages of development on vines grown at two different photon flux densities. *Aust J Plant Physiol*. 2001;28:373–82.
- [11] do Amarante TCV, Steffens CA, Argenta LC. Yield and fruit quality of ‘Gala’ and ‘Fuji’ apple trees protected by white anti-hail net. *Sci Hortic*. 2011;29:79-85.
- [12] Hunsche M, Blanke MM, Noga G. Does the microclimate under hail nets influence micromorphological characteristics of apple leaves and cuticles? *J Plant Physiol*. 2010;167:974-80.
- [13] Kuhrt U, Samietz J, Dorn S. Effect of plant architecture and hail nets on temperature of codling moth habitats in apple orchards. *Entomol Exp Appl*. 2006;118:245-59.
- [14] Fletcher JM, Tatsiopoulou A, Mpezamihigo M, Carew JG, Henbest RGC, Hadley P. Far-red light filtering by plastic film, greenhouse-cladding materials: Effects on growth and flowering in *Petunia* and *Impatiens*. *J Hort Sci Biotechnol*. 2005;80:303–6.
- [15] Basile B, Romano R, Giaccone M, Barlotti E, Colonna V, Cirillo, C, Shahak, Y, Forlani M. Use of photo-selective nets for hail protection of kiwifruit vines in southern Italy. *Acta Hort*. 2008;770:185-92.
- [16] Bastías RM, Manfrini L, Corelli Grappadelli L. Exploring the potential use of photo-selective nets for fruit growth regulation in apple. *Chil J Agr Res*. 2012;72(2):224-31.
- [17] Bastías RM, Corelli-Grappadelli L. Light quality management in fruit orchards: physiological and technological aspects. *Chil J Agr Res*. 2012;72(4):574-81.
- [18] Brant RS, Pinto JEBP, Rosa LF, Albuquerque CJB, Ferri PH, Corrêa RM. Growth, content and composition of lemon balm essential oil cultivated under colour shading net. *Cienc Rural*. 2010;39:1401-7.

471 [19] Kong Y, Avraham L, Perzelan Y, Alkalai-Tuvia S, Ratner K, Shahak Y, et al. Pearl netting
472 affects postharvest fruit quality in ‘Vergasa’ sweet pepper via light environment manipulation.
473 Sci Hort 2013;150:290–8.
474

475 [20] Tinyane PP, Sivakumar D, Soundy P. Influence of photo-selective netting on fruit quality
476 parameters and bioactive compounds in selected tomato cultivars. Sci Hortic. 2013;161:340–9.
477

478 [21] Martínez-Gutiérrez GA, Nicolàs-Santana L, Ortiz-Hernández YD, Morales I, German F.
479 Gutiérrez-Hernández GF. Growth and oil content of basil (*Ocimum basilicum* L.) grown under
480 coloured shade nets. Interciencia, 2016;41(6):428-32.
481

482 [22] Huang H, Li Z, Li J, Kubisiak TL, Layne DR. Phylogenetic relationships in *Actinidia* as
483 revealed by RAPD analysis. J Am Soc Hort Sci. 2002;127:759–66.
484

485 [23] Testolin R, Messina R, Youssef J. Indagine sulla fertilità dell’actinidia. Rivista Fruttic.
486 1985;5:59-64.
487

488 [24] Corral CS, Casal OA, Fernández PV. Ciclo vegetativo de *Actinidia deliciosa* en la
489 comunidad gallega. Actas Hortic. 1997;15:521-28.
490

491 [25] Slinkard K, Singleton VL. Total phenol analysis: Automation and comparison with manual
492 methods. Am J Enol Viticult. 1997;28:49–55.
493

494 [26] Pellegrini N, Re R, Yang M, Rice-Evans C. Screening of dietary carotenoids and
495 carotenoid-rich fruit extracts for anti-oxidant activities applying 2,2’-azino-bis-(3-
496 ethylenebenzothiazoline-6-sulphonic acid) radical cation decolourisation assay. Method
497 Enzymol. 1999;299:379–89.
498

499 [27] Re R, Pellegrini N, Proteggente A, Pannala A, Yang M, RiceEvans C. Antioxidant activity
500 applying an improved ABTS radical cation decolourisation assay. Free Radic Bio Med.
501 1999;26:1231–37.
502

503 [28] Scalzo J, Politi A, Pellegrini N, Mezzetti B, Battino M. Plant genotype affects total
504 antioxidant capacity and phenolic contents in fruit. Nutr. 2005;21(2):207–13.
505

506 [29] Shahak Y, Gussakovsky EE. Colour Nets: crop protection and light quality manipulation
507 in one technology. Acta Hortic. 2004;659:143-51.
508

509 [30] Castellano S, Scarascia Mugnozza G, Russo G, Briassoulis D, Mistriotis A, Hemming S,
510 Waaijenberg D. Plastic nets in agriculture: a general review of typologies and applications.
511 Biosyst Eng. 2008;24:799-08.

512 [31] Cosgrove DJ. Rapid suppression of growth by blue light. Occurrence, time course, and
513 general characteristics. Plant Physiol. 1981;67:584–90.
514

515 [32] Maas FM, Bakx EJ, Morris DA. Photocontrol of stem elongation and dry weight
516 partitioning in *Phaseolus vulgaris* L. by the blue light content of photosynthetically photon flux.
517 J Plant Physiol. 1995;146:665–71.
518

519 [33] Fletcher JM, Tatsiopoulou A, Mpezamihigo M, Carew JG, Henbest RGC P. Hadley P.
520 Far-red light filtering by plastic film, greenhouse-cladding materials: effects on growth and
521 flowering in *Petunia* and *Impatiens*. J Hort Sci Biotechnol. 2005;80:303-6.
522

523 [34] Huckstadt AB, Mortensen LM, Gislerod HR. The effect of high maximum day
524 temperatures and coloured film cover on growth and morphogenesis of some herbs in a CO₂
525 enriched greenhouse atmosphere. Eur J Hort Sci. 2013;5:203-8.
526

527 [35] Ilias IF, Rajapakse N. The effect of end-of-the-day red and far-red light on growth and
528 flowering of *Petunia*×*hybrida* ‘countdown burgundy’ grown under photosensitive films
529 HortScience. 2005;40:131-33.
530

531 [36] Runkle ES, Heins RD. Stem extension and subsequent flowering of seedlings grown under
532 a film creating a far-red deficient environment. Sci Hort. 2002;96:257-65.
533

534 [37] Stapel JO, Maugin E, Trihan S, Ferre A. Light filter use in ornamental plant production to
535 control plant growth and to improve plant quality. Acta Hort. 2011;907:205-11.
536

537 [38] Niinemets U, Di’az-Espejo A, Flexas J, J. Galme’s J, Warren CR. Importance of mesophyll
538 diffusion conductance in estimation of plant photosynthesis in the field. J Exp Bot.
539 2009;60(8):2271–82.
540

541 [39] Machado R, Ribeiro R, Marchiori P, Machado D, Machado E, Landell M. Biometric and
542 physiological responses to water deficit in sugarcane at different phenological stages. Pesqui
543 Agropecu Bras. 2009;44:1575–82.

544 [40] Endres L, Silva JV, Ferreira VM, Barbosa GVS. Photosynthesis and water relations in
545 Brazilian sugarcane. Open Agric. J. 2010;11: 31–7.

546 [41] Montanaro G, Treutter D, Xiloyannis C. Phenolic compounds in young developing
547 kiwifruit in relation to light exposure: Implications for fruit calcium accumulation. J Plant
548 Interact. 2007;2:63–9.
549

550 [42] Cipriani G, Testolin R. ‘Jintao’: a Chinese Kiwifruit Selection Grown in Italy. Acta Hort.
551 2007;753:247-52.

552 [43] Gullo G, Dattola A, Zappia R. Comparative study of some fruit quality characteristics of
553 two of *Annona cherimola* Mill. grown in southern Italy. AIMS Agric Food. 2019;4(3):658-71.
554

555 *Table 1. Main characteristics of the five photoselective colour net to the comparison.*

Materials	HDPE				
	Black	Red	Yellow	White	Grey
Shading (%)	14	9	4	7	19
Mesh size (mm)	3 x 8			2.4 x 4.8	
Weight (gr/m ²)	48			60	
String diameter (mm)			0.30		
Texture			leno weave		

556

557

558 *Table 2 – PAR and UV radiations and Temperature measured under five photoselective colour nets*
559 *and in the Open Field at 12:00 a.m. during four clear summer days at the end of June, July, and*
560 *August (average of June, July and August months on two years).*

561

Treatment	PAR ($\mu\text{mol.m}^{-2}\text{s}^{-1}$)	UV ($\mu\text{mol.m}^{-2}\text{s}^{-1}$)	Temperature ($^{\circ}\text{C}$)
Black net	1202b	84.50b	27.24bc
Red net	1158b	74.35c	26.79c
Yellow net	1246b	79.86b	27.68b
White net	1235b	79.57b	28.15b
Grey net	1118b	80.84b	28.47b
Open Field	1429a	96.94a	32.30a
Year	*	*	*
Treatment x Year	n.s.	n.s.	n.s.

562 (Different letters and * indicate significant differences for $p \leq 0.05$; n.s.= non-significant)

563

564

565

566 *Table 3 – Blue, Red, and Far-Red light measured under five photoselective colour nets and in*
 567 *the open field .at noon. during four clear summer days at the end of June, July, and August*
 568 *(average of June, July and August months on two years)*

569

Treatment	BL ($\mu\text{moles.m}^{-2}.\text{s}^{-1}$)	RL ($\mu\text{moles.m}^{-2}.\text{s}^{-1}$)	FRL ($\mu\text{moles.m}^{-2}.\text{s}^{-1}$)	R/FR
Blake net	260.72a	307.90b	278.43b	1.10n.s.
Red net	223.35b	343.56a	331.38a	1.03
Yellow net	220.07b	338.87a	327.76a	1.03
White net	228.96b	318.45b	311.25ab	1.02
Grey net	227.48b	310.19b	285.84b	1.08
Open Field	288.10a	353.03a	330.30a	1.07
Years	*	*	*	*
TxY	n.s.	n.s.	n.s.	n.s.

570 BL=Blue light; RL= Red light; FRL=Far-Red Light

571 (Different letters and * indicate significant differences for $p \leq 0.05$; n.s.= non-significant)

572

573 Table 4 – Fertility indices, mixed shoots, shoot length, and LAI in kiwifruit tree, Jintao cv,
574 trained under five photoselective colour nets.

575

Treatment	RF	FI	MS (%)	SL (cm)	LAI
Black net	3.01c	4.90ab	60.47c	18.62c	2.23n.s.
Red net	5.10a	5.19a	98.17a	24.86b	2.33
Yellow net	5.00a	5.14a	97.18a	25.62b	2.15
White net	3.99b	4.19b	95.12a	32.06a	2.18
Grey net	3.68b	3.94c	92.72a	29.81a	2.59
Open field	4,45ab	5,13a	92.35b	20.15b	2.33
Years	*	*	*	**	*
TxY	n.s	n.s	n.s	n.s.	n.s.

576 R.F. =real fertility; F.I. Fertility index; MS=Mixed Shoots; SL= Shoot Length; LAI=Leaf Area
577 Index

578 (Different letters and * indicate significant differences for $p \leq 0.05$; n.s.= non-significant)

579

580

581

582 *Table 5 – Gas exchange (An, GS, Ci), and carboxylation efficiency (Pn/Ci) in kiwifruit leaf,*
583 *Jintao cv, trained under photoselective colour nets and in the Open Field. The measurements*
584 *were carried out during the four clean summer days (25, 26, 27 July 2017;27,28,29 July 2018)*
585 *from 9:00-10:00 a.m.*

586

Treatment	Pn ($\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$)	gs ($\mu\text{mol H}_2\text{O m}^{-2} \text{ s}^{-1}$)	Ci (ppm)	Pn/Ci
Black net	14.27b	0.38a.	245.66b	0.063a
Red net	18.22a	0.33a	261.99ab	0.069a
Yellow net	13.48b	0.37a	291.33ab	0.046b
White net	13.89b	0.33a	302.77a	0.046b
Grey net	11.88c	0.34a	329.04a	0.036c
Open field	5.56d	0.27b	311.33c	0.018d
Years	*	*	*	n.s
TxYears	n.s	n.s.	n.s.	n.s.

587 Pn Net Photosynthesis; gs= stomatal conductance; Ci= internal concentration CO₂
588 (Different letters and * indicate significant differences for p≤ 0.05; n.s.= non-significant)
589

590 *Table 6 –Fluorescence parameter in kiwifruit leaf, Jintao cv, trained under six colour net and*
591 *in the Open Field. The measurements were carried out during the four clean summer days (25,*
592 *26, 27 July 2017;27, 28, 29 July 2018) from 10:00-11:00 a.m.*

Treatments	Fv/Fm	ΦPSII	qP	ETR
Black net	0.75a	0.18ab	0.46b	158b
Red net	0.75a	0.21a	0.51a	186a
Yellow net	0.63ab	0.20a	0.45b	177b
White net	0.58c	0.16bc	0.41b	145bc
Grey net	0.44d	0.15c	0.37c	141c
Open field	0.40e	0.13d	0.35c	136c
Years	*	*	*	n.s.
TxY	n.s.	n.s.	n.s.	n.s

594 (Different letters and * indicate significant differences for $p \leq 0.05$; n.s.= non-significant)

595

596 *Table 7 – Carpometric measurements in kiwifruit, Jintao cv, trained under photosensitive*
597 *colour nets. Harvest 31 October 2016 and 1 November 2016*
598

Treatments	FW (g)	H (mm)	D (mm)	H/D
Black net	89.29ab	65.20n.s.	48.26a	1.37ab
Red net	92.44a	65.28	48.99a	1.36ab
Yellow net	84.35ab	63.41	47.80a	1.35b
White net	89.92ab	64.77	48.54a	1.36b
Grey net	78.76b	63.39	46.99b	1.40a
Open field	70.15C	62.70	45.48b	1.37b
Years	*	*	*	*
Y xT	n.s.	n.s.	n.s.	n.s.

599 FW=Fresh weight; H=Height; Diameter

600 (Different letters and * indicate significant differences for $p \leq 0.05$; n.s.= non-significant)
601

602 *Table 8 – Production, in kiwifruit, Jintao cv, trained under photoselective colour nets and in*
603 *the open field.*

604

Treatment	Fruits (N°)	Yield (Kg.tree ⁻¹)	Yield (q.ha ⁻¹)
Black net	470.71d	42.10c	336.81c
Red net	614.96a	56.84a	454.72a
Yellow net	652.69a	55.05a	440.4a
White net	551.89b	49.62b	396.96b
Grey net	528.06d	41.18c	329.5c
Open field	550.05c	38.58d	308.6d
Years	*	*	*
Treatment xYears	n.s.	n.s.	n.s.

605 (Different letters and * indicate significant differences for $p \leq 0.05$; n.s.= non-significant)

606

607

608 *Table 9 - Colourimetric parameters of kiwifruit pulp, Jintao cv, trained under five*
609 *photosensitive colour nets and in the open Field.*
610

Treatments	L*	a*	b*	Chroma	Hue
Black net	64.42b	-0.37c	18.60a	30.29n.s.	98.27b
Red net	60.32bc	0.66a	18.17a	30.89	96.44c
Yellow net	60.91bc	0.32b	16.35b	30.01	99.62b
White net	66.90a	-1.34e	18.69a	30.87	99.12b
Grey net	59.27c	-0.59d	15.27b	31.20	100.23b
Open field	64.77b	-5.5525	30.67333	31.16	103.25a
Years	n.s.	n.s.	n.s.	n.s.	n.s.
YxT	n.s.	n.s.	n.s.	n.s.	n.s.

611 (Different letters and * indicate significant differences for $p \leq 0.05$; n.s.= non-significant)
612

613 *Table 10 – Maturation indices in kiwifruit, Jintao cv, trained under five photosensitive colour*
614 *nets. Harvest date 31 October 2016, 1 November 2017.*

615

Treatment	FF (Kg.cm ⁻²)	TSS (°brix)	TA (%)	TSS/TA	DMC (%)
Black net	8.71b	8.95b	1.21b	7.40b	15.82b
Red net	9.06a	11.92a	1.36a	8.76a	19.61a
Yellow net	8.89b	9.94b	1.11bc	8.95a	16.49b
White net	8.18bc	6.99bc	1.16bc	6.03c	15.70b
Grey net	7.22c	6.25c	1.07c	5.84c	13.93c
Open field	8.00bc	5.19d	1.08c	4.98d	12.91d
Years	n.s.	*	*	*	n.s.
TXY	n.s.	n.s.	n.s.	n.s.	n.s.

616 *FF=Firmness Flesh; TSS=Total Soluble Solids; TA=Titratable Acidity; DMC=Dry Matter*
617 *Content*

618 Different letters and * indicate significant differences for $p \leq 0.05$; n.s.= non-significant)

619

620 *Table 11 – Nutraceutical parameters in kiwifruit, Jintao cv, trained under photoselective colour*
621 *nets. Harvest 31 October 2017 and 1 November 2019*
622

Treatment	TPC (mg GAE/ g FW)	TAC (μ mol trolox/ gr. FW)	FT (mg quercetin/ gr FW)	AA (mg AA/100 ml)	Chl μ gr/gr FW	Car μ gr/gr FW
Black net	0.74b	7.01a	0.70 b	121.02a	9.74b	2.09c
Red net	1.01a	7.16a	0.70b	112.46a	8.94b	1.94c
Yellow net	0.94ab	6.11a	0.79b	112.13a	10.19a	3.08a
White net	1.09a	5.87b	0.87a	91.38b	10.34a	2.44b
Grey net	0.89ab	5.80b	0.54c	100.64b	10.71a	2.29b
Open field	0.96ab	7.76a	0.55c	100.22b	10.49a	2.90b
Years	n.s	**	n.s	**	n.s	n.s
TXY	n.s	n.s	n.s	n.s	n.s	n.s

623 TPC=Total Polyphenols Content; TAC= Total Antioxidant Capacity; FT=Totals Flavonoids; AA=
624 Ascorbic acid; Chl=Chlorophyll; Car= Carotenoids.

625 Different letters and * indicate significant differences for $p \leq 0.05$; n.s.= non-significant)
626

627

628

Table 12 – Correlations between variables and factors in PCA

	F1	F2	F3	F4	F5
L*	-0,1591	-0,2358	0,2916	-0,5590	-0,7222
a*	0,7698	0,4102	-0,3410	0,3304	0,1170
b*	-0,5843	-0,3966	0,6045	-0,3654	0,0500
Chr	-0,5084	0,1881	-0,2722	-0,6566	0,4483
°H	-0,9691	-0,0006	0,2095	0,0737	-0,1075
FW	0,9904	-0,0543	-0,0999	0,0448	0,0650
H	0,8690	-0,2435	-0,1704	-0,3802	-0,1093
H/D	-0,8148	-0,3777	-0,3968	-0,1273	0,1407
D	0,9674	0,0795	0,1305	-0,1498	-0,1352
Yield	0,5495	0,7223	0,4057	0,0422	0,0994
FF	0,8725	-0,4411	0,0357	0,1970	-0,0639
TSS	0,5989	-0,1406	0,6144	0,0551	0,4909
DMC	0,7294	-0,4376	0,1906	-0,4878	0,0479
TA	0,8255	-0,1656	0,1579	-0,3218	0,4033
TSS/TA	-0,1405	-0,0774	0,8084	0,5450	0,1537
Chl	0,0017	0,3734	0,3037	0,8339	-0,2702
Car	-0,9773	0,1114	0,1562	0,0875	-0,0217
TPC	0,0193	0,8253	0,2881	-0,4836	-0,0410
TAC	-0,1285	-0,5803	0,6341	-0,2674	0,4161
FT	0,6833	0,1520	0,4430	0,0507	-0,5578
AA	0,6523	-0,5050	0,1829	0,3470	0,4070
Pn/Ci	0,9680	-0,2147	-0,0855	-0,0259	0,0939
Pn	0,9620	0,1304	-0,2268	-0,0073	0,0776
gs	-0,2089	0,6843	-0,5692	-0,1392	0,3804
Ci	-0,7056	0,6830	-0,1748	-0,0093	0,0708
T°	-0,9079	-0,0892	0,3573	-0,1944	0,0476
LAI	-0,1954	0,0789	-0,7755	0,0052	0,5951
R.F.	0,4188	0,8413	0,2779	0,1817	0,0819
F.I.	0,9466	0,1477	-0,0259	0,1917	-0,2114
MS	-0,1247	0,9229	0,2161	-0,0665	0,2856
SL	-0,1947	0,8652	-0,3437	-0,2634	-0,1612
Bl	-0,6067	-0,6599	0,3729	-0,2394	-0,0030
RL	-0,1777	0,2597	0,8540	-0,0334	0,4131
FRL	-0,0062	0,5490	0,7915	-0,0912	0,2525
R/FR	-0,3782	-0,8208	-0,3748	0,1571	0,1347
Fv/Fm	0,7780	-0,3708	-0,1825	0,3438	0,3252
FPSII	0,8881	0,1398	-0,0391	-0,4127	-0,1412
qP	0,9581	-0,0575	0,0595	-0,2717	0,0365
ETR	0,8098	0,1761	0,0162	-0,5593	-0,0135

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634 List of captions

635 Figure 1 – Light spectrum under five photoselective colour nets and the open field.

636 Figure 2 - Relationship between Red Light and Real Fertility index.

637 Figure 3 - Relationship between Far-Red Light and Fertility index.

638 Figure 4 - Size classes of kiwi fruit in the plants grown under five photoselective colour nets.

639 Figure 5 - Representation of the projection of the variables on the F1-F2 plane.

640 Figure 6 - Representation of the projection of the variables on the F1-F2 plane.

641 Figure 7 – Bi-plot with photoselective colour net centroid and variable vectors on F1 and F2 plane.

642 Figure 8 – B-iplot with photoselective colour net centroid and variable vectors on F3 and F4
643 plane.
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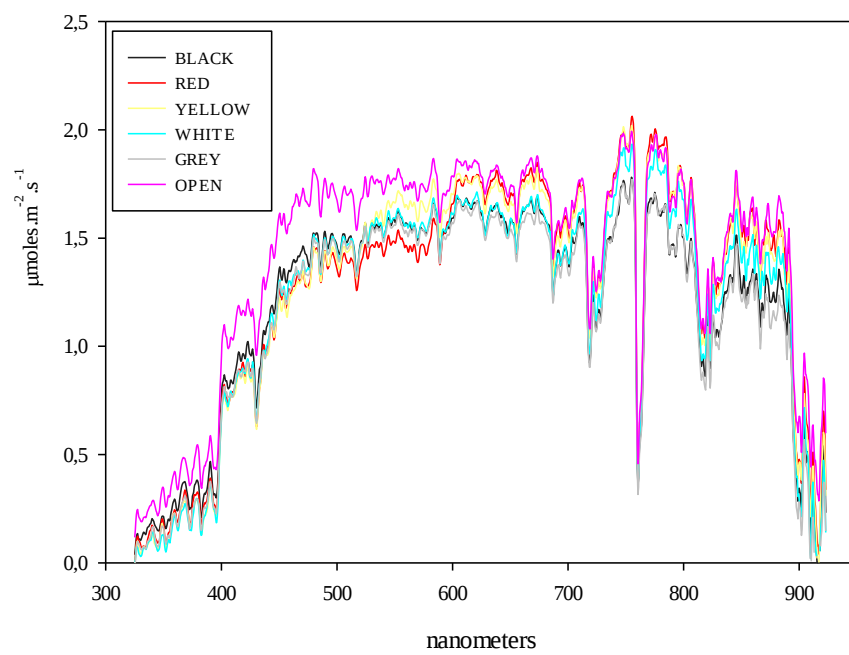


Figure 1 - Light spectrum under five photosensitive colour nets and the open field

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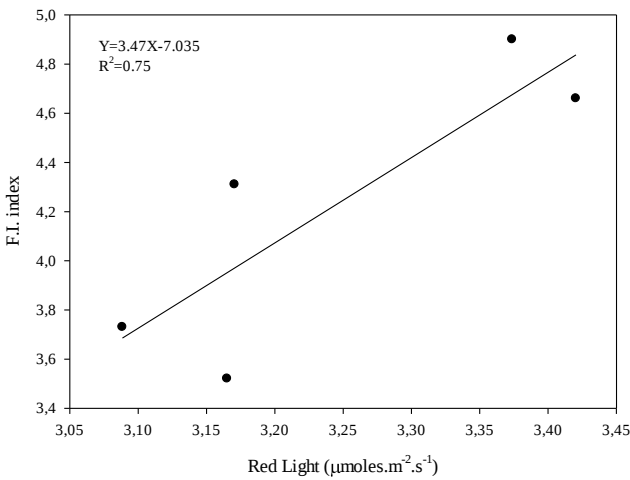


Figure 2 - Relationship between Red Light and Fertility Index in tree of *Actinidia chinensis*, cv Jintao

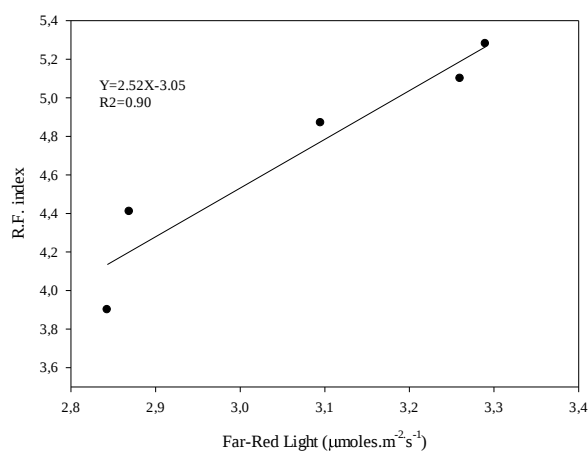


Figure 3 - Relationship between Far-Red Light and Real Fertility index in tree of Actinidia chinensis, cv Jintao

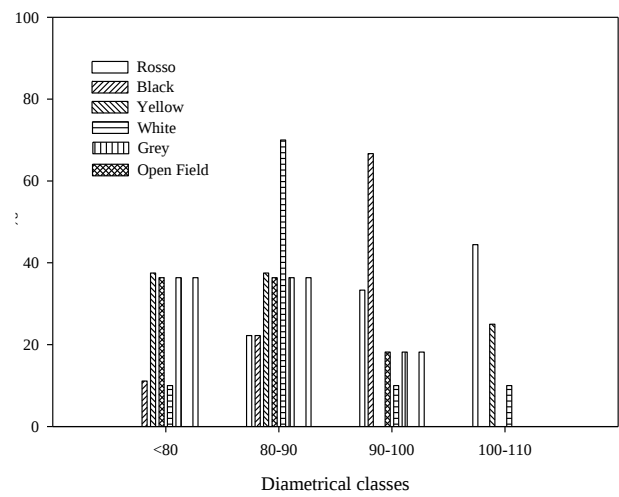


Figure 4 - Size classes of kiwi fruit in the Jintao trees grown under five photosensitive colour nets and the open field

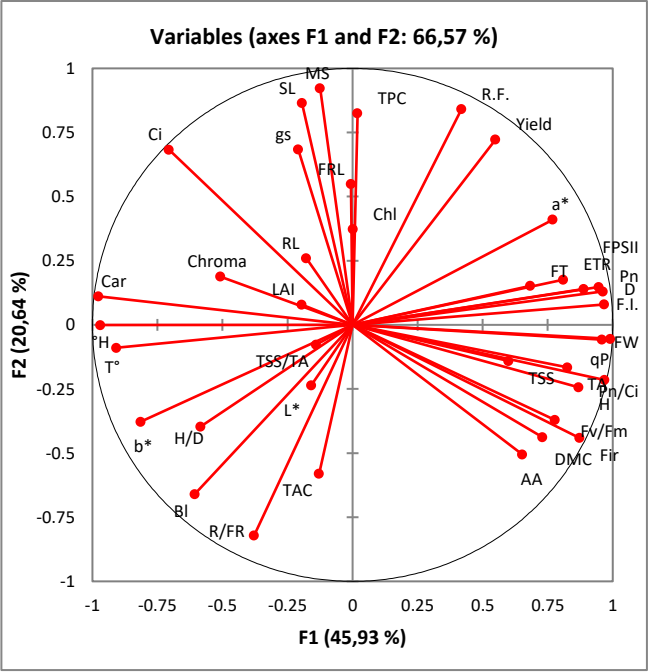
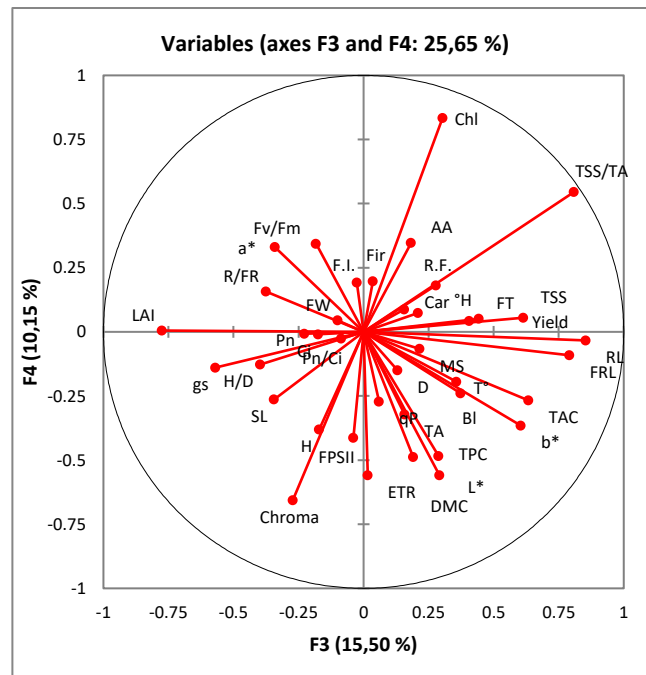
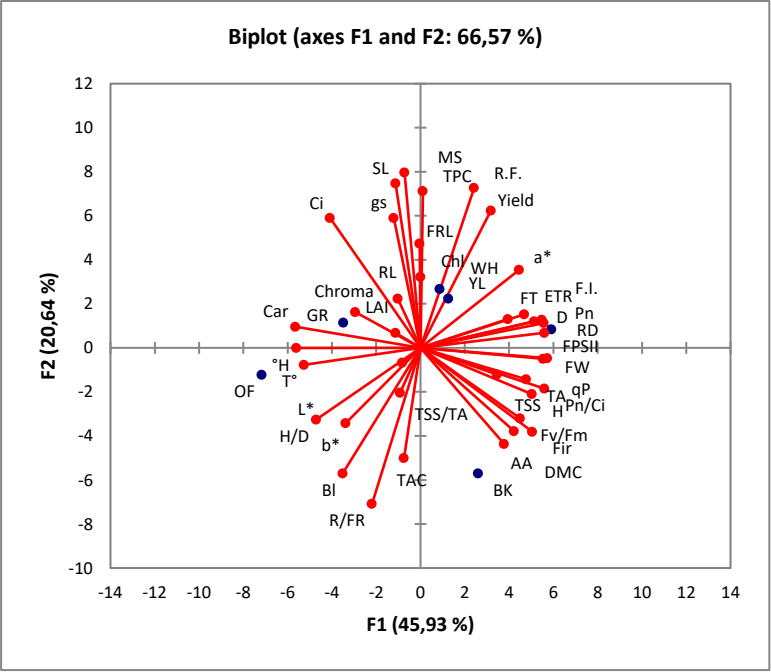


Figure 5 - Representation of the projection of the variables on F1-F2 plane





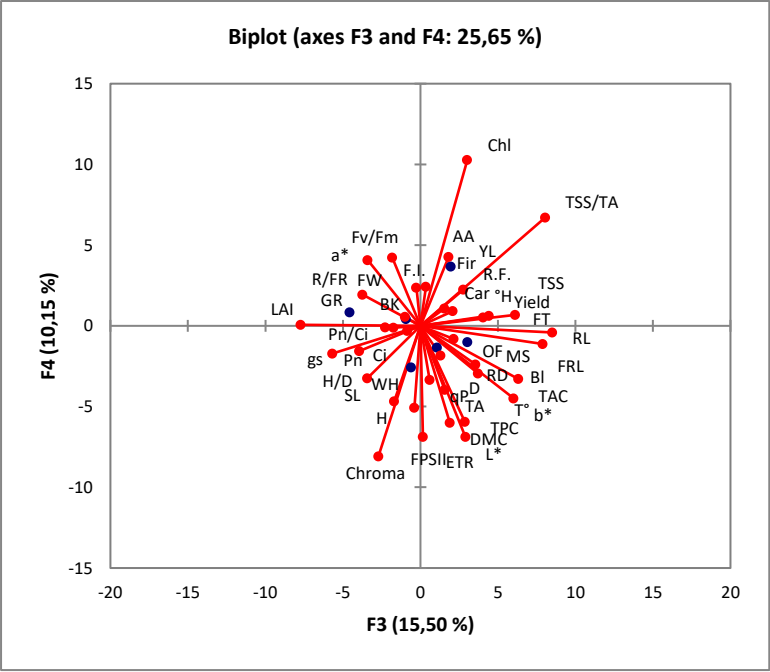


Figure 8 – Bi-plot with photoselective colour net centroid and variable vectors on F3 and F4 plane.