Summary of Spring Fungicides – 2021/22

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Summary:

1. Two replicated field trial were established in each of two commercial pyrethrum fields in August 2021 to test the efficacy of fungicides as either the first spray in the commercial spring program (Single) or as two standalone sprays (Double) for the management of spring fungal diseases
2. Foliar disease incidence was low at site 469105 (< 2% for *D. tanaceti* and *S. tanaceti*) prior to treatment application and moderately high (49 % *D. tanaceti*; 9 % *S. tanaceti*) at 507018
3. No yield benefits were associated with any of the tested fungicide products when incorporated as a single spray in the commercial program
4. When two sprays of a fungicide treatment were deployed Belanty (2.3x Non), Intervene (1.7x Non), Jubilee-H (1.7x Non) and Switch (2.0x Non) significantly increased pyrethins yield relative to nontreated plots at 507018; but no yield benefits were observed at 469105
5. Incidences of *S. tanaceti* and *D. tanaceti* in October following treatment applications were negatively correlated with biomass and pyrethrins yield across all trial plots; this suggests that the lack of yield benefit at 469105 was associated with low disease pressure at this site

Aims:

1. Evaluation the efficacy of fungicide products for the control of foliar diseases in spring
2. Examine relationships between yield and foliar disease

Methods:

- Two replicated trials were established at each of sites 507018 and 469105
- The first trial at each site consisted of a single (Single trial) application of the treatment in late August followed by the remaining two application of the commercial spring program
- The second trial at each site consisted of two applications (Double trial) of the treatment product in late August and mid September.
- Nine treatments with six replicate plots per treatment were incorporated into each trial (Table 1)
- Crop canopy development (as NDVI) was assessed pre-treatment (August)
- Pathogen incidence was assessed in blocks (pre-treatment in August) and in plots post-treatment (late September to mid-October) in Double trial only
- Flowering stem development and defoliation were assessed in early November at 646008
- Crop yield was estimated by cutterfront harvest and flower subsampling for pyrethrins assay in December/January

Table 1 Details of fungicide products incorporated within the trial.

Treatment	Product	Active	Manufacturer	Application Rate
Switch	Switch ® Fungicide	Cyprodinil (375 g/kg); Fludioxonil (250 g/kg)	Syngenta Australia	1 kg/ha
Sercadis-L	Sercadis ®	Fluxapyroxad (300 g/L)	BASF Australia	165 mL/ha
Sercadis-H	Sercadis ®	Fluxapyroxad (300 g/L)	BASF Australia	400 mL/ha
Jubilee-L	Jubilee ® 500	Flutriafol (500 g/L)	Adama Australia	120 mL/ha
Jubilee-H	Jubilee ® 500	Flutriafol (500 g/L)	Adama Australia	250 mL/ha
Intervene	Intervene WG	Polyoxin D zinc salt (113 g/kg)	Nufarm Australia	350 g/ha
Dragon	Dragon ® 700 WG	Dithianon (700 g/kg)	Nufarm Australia	800 g/ha
Belanty	Belanty ® Fungicide	Mefentrifluconazole (75 g/L)	BASF Australia	2 L/ha
Non	Control			

Key Results:

1. Incidence of the key foliar pathogens in pyrethrum plants pre-treatment varied between sites (Fig. 1):
    a. At 469105 *D. tanaceti* and *S. tanaceti* incidence was 1.7 and 0 %, respectively
    b. At 507018, *D. tanaceti* and *S. tanaceti* incidence was 49 and 8.7 %, respectively
2. Post-treatment incidence of *S.* tanaceti and *D.* tanaceti was associated with both treatment and site (Fig. 1):
    a. At 469105, mean incidence of *D. tanaceti*, *S. tanaceti*, *I. perplexans* and *C. tanaceti* were all 5% or less for individual treatments; no differences between treatments were observed for any of these pathogens
    b. At 507018:
        i. mean incidence of *D. tanaceti* was statistically associated with treatment, with Belanty (10%) and Switch (12%) significantly lower than Non (33%)
        ii. mean incidence of *S. tanaceti* was statistically associated with treatment, with Belanty (1.7%), Sercadis-H (2.5%), Switch (3.3%) and Sercadis-L (4.1%) significantly lower than Non (21%)
        iii. mean incidences of *I. perplexans* and *C. tanaceti* were less than 5% for all treatments and not statistically associated with treatment
3. Fungicide treatment was not observed to significantly effect stem height (57 and 52 cm) or stem defoliation (38 and 33%) at 469105 or 507018 across either trial (Fig. 2)
4. Disease symptoms observed in stems in November typically varied with site (Fig. 3):
    a. Sclerotinia crown rot
        i. In the Single spray trial, only Belanty at 469105 was observed to reduce incidence relative to Non, with no treatment effects at 507018
        ii. In the Double spray trial, no treatments significantly reduced incidence in stems relative to Non
    b. Foliar blight
        i. In the Single spray trial only Belanty at 469105 was observed to reduce incidence relative to Non, with no treatment effects at 507018

ii. In the Double spray trial, no treatments significantly reduced incidence in stems relative to Non

c. No treatment in either trial was observed to significantly reduce the incidence of canker symptoms relative to Non
d. No impact of treatment on diseased bud severity was observed in either trial across both sites

5. Yield effects differed between trials (Fig. 4)
    a. In the Single trial, no treatment significantly increased biomass, assay or pyrethrins yield relative to Non at either site
    b. In the Double trial:
        i. No treatment effects were observed at 469105
        ii. At 507018,
            1. Biomass was significantly higher in Belanty (2.6x Non) and Switch (2.3x Non) plots relative to Non
            2. Pyrethrins yield was significantly higher in Belanty (2.3x Non), Intervene (1.7x Non), Jubilee-H (1.7x Non) and Switch (2.0x Non) plots relative to Non
            3. Assay was not associated with treatment
6. Spearman's rank pairwise correlations between measured parameters across both trials indicated, following Bonferroni correction for multiple pairwise comparisons ($P \leq 0.05$), that (Fig. 5):
    a. Incidence of *S. tanaceti* and *D. tanaceti* in October were negatively correlated with biomass and pyrethrins yield
    b. Plant density in August was negatively correlated with pyrethrins yield
    c. Stem height, defoliation height and Sclerotinia crown rot incidence in stems in November was positively correlated with pyrethrins yield

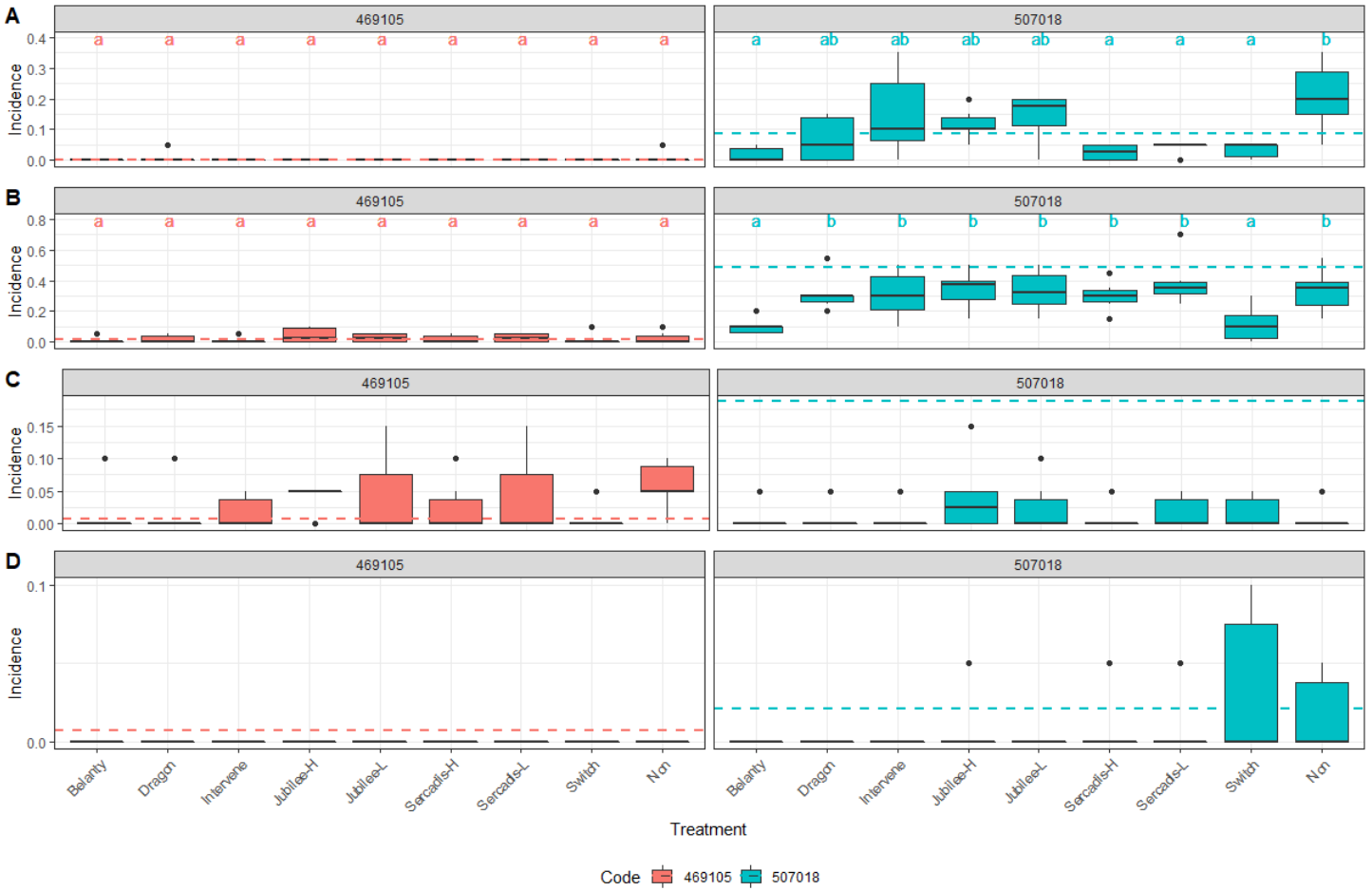

Fig. 1 Incidence of fungal pathogens in pyrethrum leaves across both trial sites in Double spray trial; A) *Stagonosporopsis tanaceti*; B) *Didymella tanaceti*; C) *Itersonilia perplexans*; and D) *Colletotrichum tanaceti*. Lower case letters of the same colour indicated honest significant difference groups from ANOVA within field sites. Dashed lines indicate mean pre-treatment estimated incidence. Groups for *D. tanaceti* are for within site comparisons only due to the presence of a significant treatment by site interaction. No treatment effects observed for *I. perplexans* or *C. tanaceti*. Central bar of boxes indicates the treatment mean. Box boundaries indicate the 25th and 75th percentiles of observations. Whiskers indicate 1.5x the interquartile mean. Dots represent outliers.

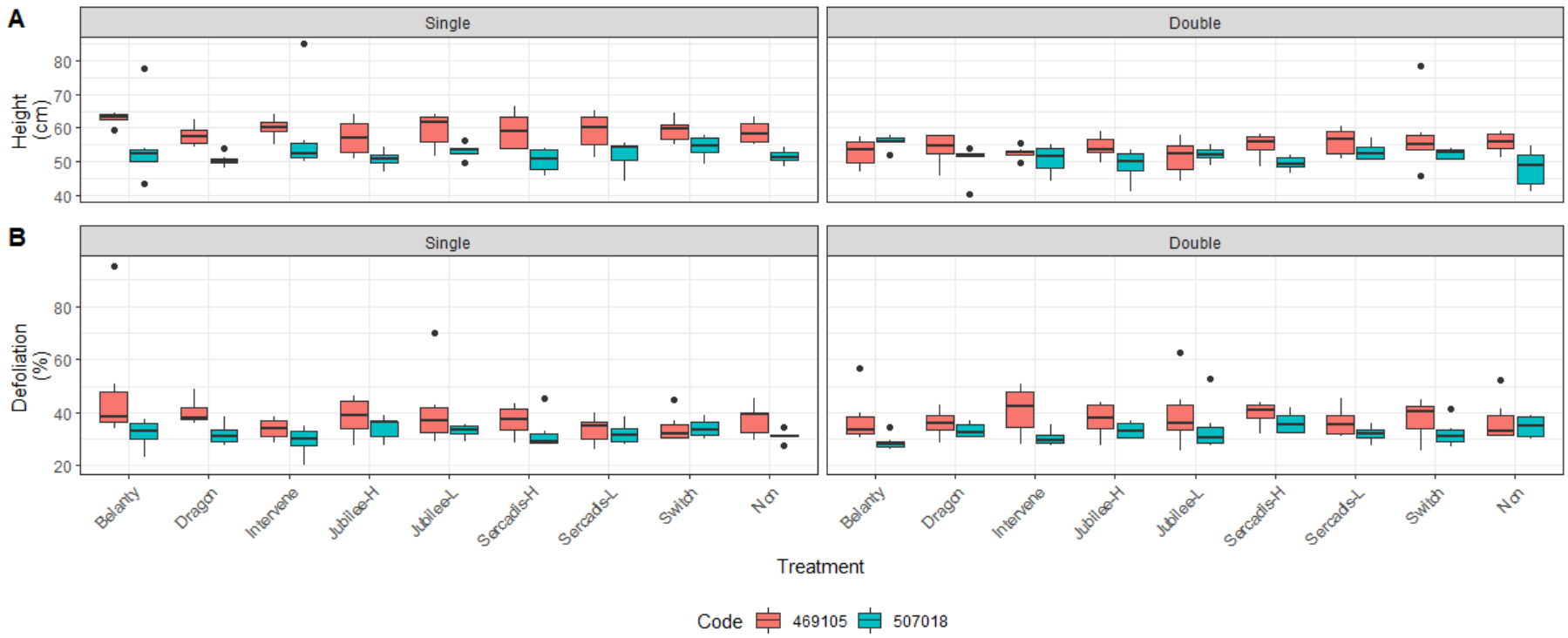

Fig. 2 Pyrethrum stem measurements from Single and Double spray trials in November 2021; A) stem height; and B) stem defoliation. No treatment effects observed. Central bar of boxes indicates the treatment mean. Box boundaries indicate the 25th and 75th percentiles of observations. Whiskers indicate 1.5x the interquartile mean. Dots represent outliers.

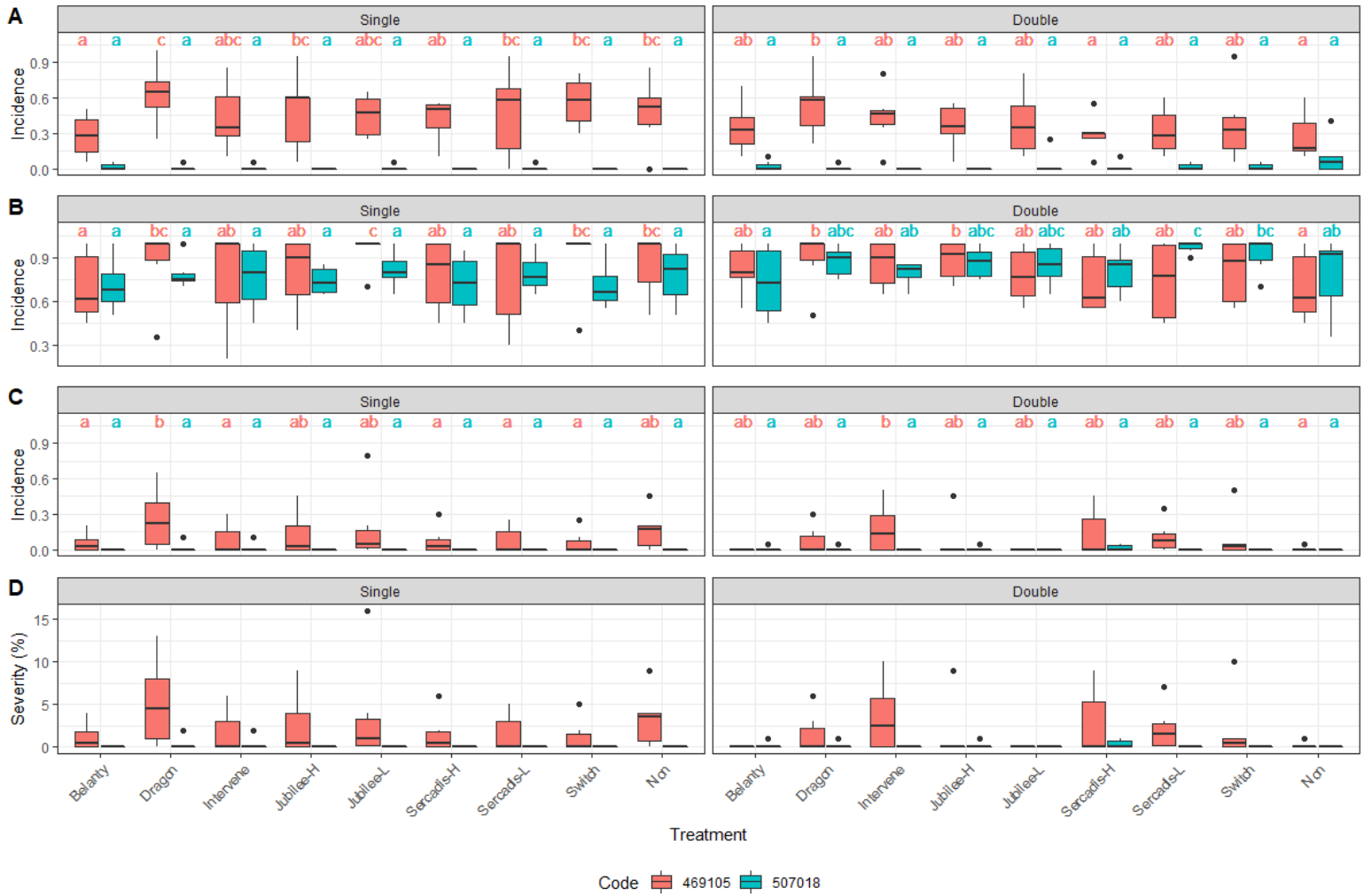

Fig. 3 Incidence of fungal disease symptoms in pyrethrum stems from Single and Double spray trials; A) Sclerotinia crown rot symptoms (SCR); B) foliar blight symptoms; C) stem canker symptoms; and D) severity of diseased buds. Lower case letters of the same colour indicated honest significant difference groups from ANOVA within field sites. No treatment effects observed for diseased buds. Central bar of boxes indicates the treatment mean. Box boundaries indicate the 25th and 75th percentiles of observations. Whiskers indicate 1.5x the interquartile mean. Dots represent outliers.

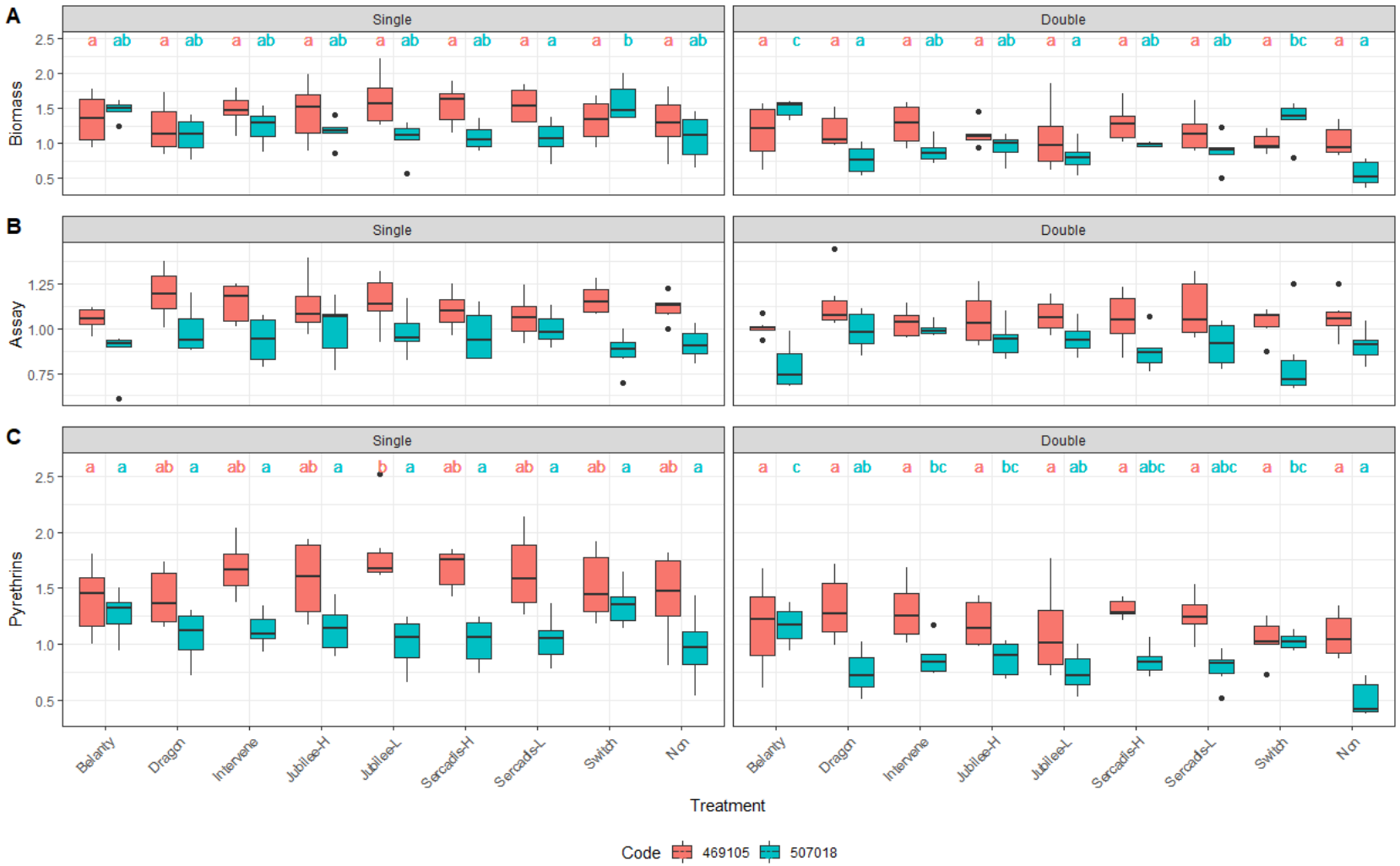

Fig. 4 Estimates of crop yield from Single and Double spray trials. **A**) Harvested crop biomass (dry weight); **B**) total pyrethrins content; and **C**) total pyrethrins yield. All yield estimates normalised to the mean of Non plots. Lower case letters of the same colour indicated honest significant difference groups from ANOVA within field sites. Central bar of boxes indicates the treatment mean. Box boundaries indicate the 25th and 75th percentiles of observations. Whiskers indicate 1.5x the interquartile mean. Dots represent outliers.

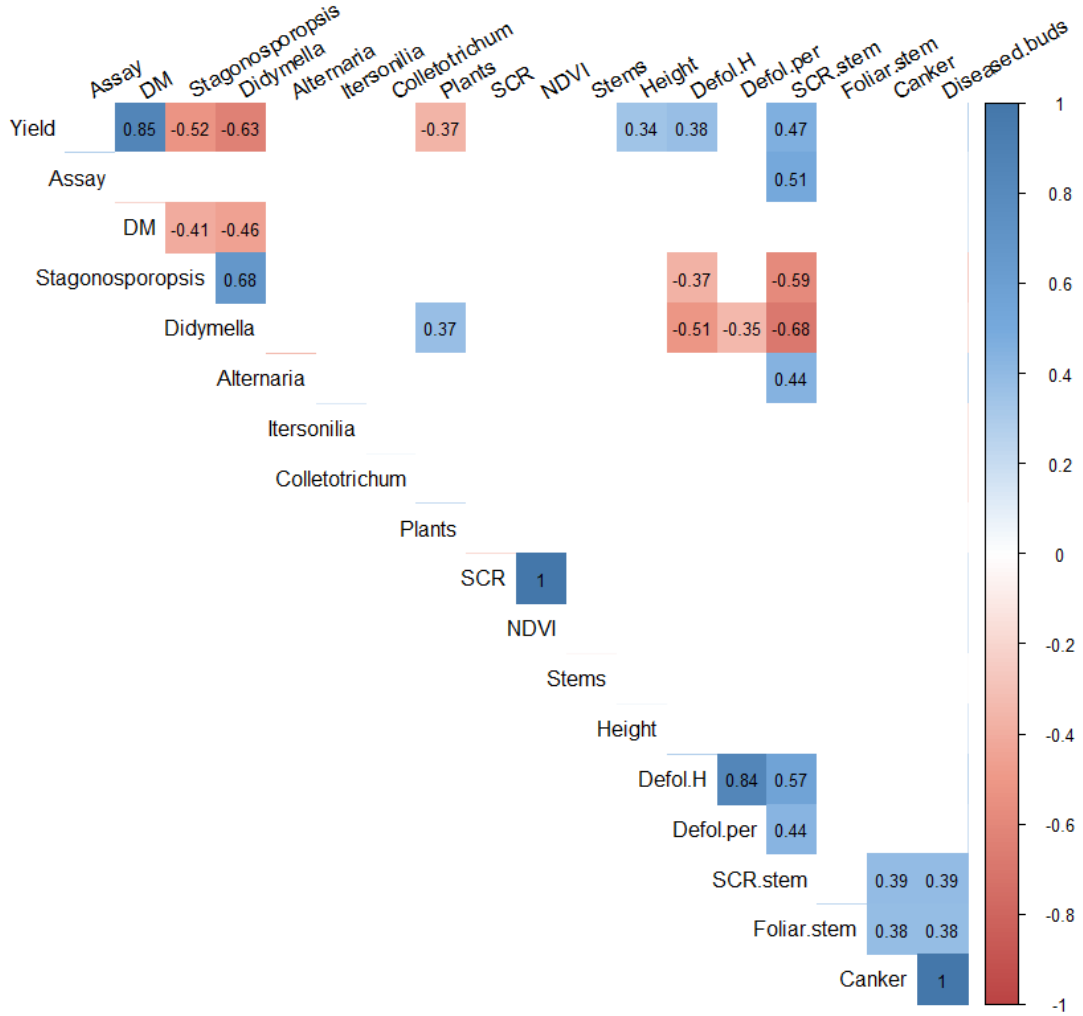

Fig. 5 Spearman's rank correlations between all measured parameters across all trials at both sites. Scale bar colour and values in squares indicate strength of estimated correlation (ρ). Only correlations statistically less than 0.05 following Bonferroni correction of multiple pairwise comparisons are shown. Labels are: Yield = pyrethrins yield, Assay = pyrethrins assay; DM = harvested biomass; Stagonosporopsis = incidence of *S. tanaceti*; Didymella = incidence of *D. tanaceti*; Alternaria = incidence of *Alternaria* spp.; Itersonilia = incidence of *I. perplexans*; Colletotrichum = incidence of *C. tanaceti*; Plants = estimated plant density in August; SCR = Sclerotinia crown rot incidence in August; NDVI = estimated vegetative canopy in August; Stems = number of stems assessed in November; Height = mean height of stems; Defol.H = mean height of defoliation of stems; Defol.per = mean percentage of stem defoliated; SCR.stem = incidence of Sclerotinia crown rot in stems; Foliar.stem = incidence of foliar disease in stems; Canker = incidence of stem canker; and Diseased.buds = severity of diseased buds on stems.