# CHAPTER 10

## THE EFFECT OF MCPA AND PACLOBUTRAZOL ON FLOWERING, BERRY SET, BIOMASS PRODUCTION, TUBER YIELD AND QUALITY OF POTATO

## 10.1 ABSTRACT

The effects of MCPA and PBZ on flowering, berry formation, dry matter production and allocation, tuber yield and quality of potato were investigated under greenhouse and field conditions at the Experimental Farm of the University of Pretoria. Both MCPA and PBZ were applied during the early and full bud stages at rates of 0, 5, 10, and 15 mg a.i. plant$^{-1}$ (greenhouse trial) and 0, 250, 500, and 750 g a.i. ha$^{-1}$ (field trial) Regardless of rate and stage of application, MCPA and PBZ prevented flowering and completely inhibited berry set. MCPA did not affect the number, yield, specific gravity and dry matter content of the tubers. Without affecting the number of tubers initiated, PBZ increased tuber yield, specific gravity and dry matter content. MCPA decreased assimilate partitioning to the stems. PBZ treatment at early flower bud stage resulted in a higher tuber yield than spraying during late flower bud stage. PBZ decreased assimilate partitioning to the leaves, stems, and roots while it increased tuber yield. A single foliar spray of MCPA or PBZ at the early flower bud stage at a rate of 250g a.i. ha$^{-1}$ is effective to reduce flower formation and prevent berry set.

**Keywords:** Berry set, flowering, MCPA, paclobutrazol, potato, quality, yield

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## 10.2 INTRODUCTION

Flowering in potato occurs in various degrees depending on the species, cultivar and environmental conditions (Sadik, 1983; Lozaya-Saldana, 1992). Its expression is influenced by internal and external factors including source-sink equilibrium, hormonal balance, physiological maturity and photoperiod (Lozaya-Saldana & Miranda-Verlazguez, 1987; Lozaya-Saldana, 1992).

The berry of potato is spherical with a diameter of 1.2 to 1.9 cm, green or purplish green tinged with violet, and contains numerous small seeds (Smith, 1968). Fruit set often does not take place, even when conditions are ideal for flowering (CIP, 1983). This seems to suggest that favourable conditions for flowering are not necessarily optimal for the processes of pollination and fruit development. Flower abscission can occur due to one or more factors such as lack of insect pollinators, poor pollen viability or temperatures too low for pollen germination and fertilization (Sadik, 1983). He also indicated that it may be due to a competition between the berries and tubers for limiting factors.

In most potato growing areas of Ethiopia the majority of the cultivars produce flowers and some of them set berries. Some of the promising elite genotypes produce many berries. The use of true potato seed has been limited to breeding and selection purposes at experimental stations. Previous reports indicated that reproductive development in potato restricts vegetative growth and tuber growth (ProundFoot, 1965; Jansky & Thompson, 1990; Tsegaw & Zelleke, 2002). In Chapter 8 and Chapter 9 it was reported that flowering and berry formation decreased vegetative growth, reduced tuber yield and quality. In addition, potato seed can remain viable in the soil for more than 10 years and be a source of unwanted volunteer plants (Lawson, 1983) that may act as weeds and alternate hosts for the persistence of nematodes, viruses, fungi and bacteria

(Lutman, 1977). Hence, the formation of berries in potato is an undesirable characteristic and there is a need for efficient control measures.

Researchers have tested different chemicals to control berry set. According to Wedgwood (1988), the best control of berry production was achieved with a combination of MCPB and Bentazone applied at the full foliage to flowering stage. Veerman & Van Loon (1993) screened MCPA, ethephone, 2,4D-amine, naphtylacetamide, metoxuron and gibberellic acid in four experiments and reported that MCPA and ethephon reduced berry set when applied at the early flower bud stage. Casual observations in trials reported in Chapter 3, Chapter 4, and Chapter 5 indicated that PBZ inhibited flower formation and berry set in potato. This Chapter reports on the effect of different rates of a single foliar spray of MCPA or PBZ applied at early or full flower bud stage on flowering, berry set, biomass production and partitioning, tuber yield and quality of potato. The objective was to determine if MCPA and PBZ can be used to control flowering and berry set without negatively affecting yield parameters.

## 10.3 MATERIAL AND METHODS

### 10.3.1 Greenhouse experiments

Separate greenhouse trials were carried out with MCPA and PBZ at the Experimental Farm of the University of Pretoria from December 2003 to March 2004. Single plant of the potato cultivar BP1 were grown in 5-liter plastic containers using a mixture of sand and coconut coir (50:50 by volume) as a growing medium. In both trials, the treatments were arranged in a two factor (rate and stage of application) factorial combination in a randomised complete block design with three replications.

Both MCPA ((4-chloro-2-methylphenoxy) acetic acid) and PBZ were applied at rates of 0, 5, 10, and 15 mg plant$^{-1}$; approximately equivalent to 0, 250, 500, and 750 g a.i. ha$^{-1}$, respectively. A single foliar spray was applied at early flower bud stage when the first flower buds started to emerge, or at full bud stage (8 days after the first application, when flower buds were swollen but before flower opening) as a fine foliar spray using an atomizer. The control plants were treated with distilled water.

During the growing period diurnal temperatures ranged between 17 and 35 ºC, and the average relative humidity was 54%. Plants were fertilized with a standard Hoagland solution and watered regularly to avoid water stress.

**10.3.2 Field experiments**

Separate field trials were conducted from December 2003 to March 2004 at the Experimental Farm of the University of Pretoria (25$^{o}$ 45‘ S; 28$^{o}$ 16‘ E; altitude 1372 m a s l) using the cultivar BP1. In both trials, treatments were arranged in a two factor (rate and stage of application) factorial combination in a randomised complete block design with three replications. Medium sized, well-sprouted tubers of cultivar BP1 were planted at a spacing of 75 x 30 cm. A row of six plants represented a treatment plot. Plots were arranged continuously without board rows, and the end plots were bordered by two rows of potato plants. Plots were fertilized with 555 kg ha$^{-1}$ of a 2: 3: 2(30) compound fertilizer and irrigated regularly to maintain adequate moisture in the soil.

A single foliar spray of both MCPA and PBZ were applied at rates of 0, 250, 500, and 750 g a.i. ha$^{-1}$.

The soil of the experimental site is sandy clay with 0.12% total nitrogen, 3 ppm phosphorus, 24 ppm potassium, and a pH ($H_20$) of 6.9. During the growing period the daily minimum temperatures ranged from 10 to 24 ºC while the maximum was between 15 and 37 ºC. Plants received a total of about 600 mm rainfall and supplemental irrigation was applied whenever necessary to prevent water stress.

### 10.3.3 Data recorded

Flowers were counted every other day. Flowers numbers represent the total number of open flowers observed per hill. Berry numbers indicate the number of mature berries per hill at harvest.

At the final harvest (eight weeks after the last treatment application) of the greenhouse trial, two pots per treatment were harvested and separated into berries, leaves, stems, tubers, and roots and stolons. In the field trial, two plants per plot were sampled for dry matter partitioning seven weeks after the last treatment application. A week later, the remaining four plants were harvested for yield and quality determination.

Plant tissues samples were oven dried at 72 °C to a constant mass. Dry matter partitioning was determined from the dry mass of individual plant parts as a percentage of total plant dry mass. Tuber specific gravity was determined using the weight in air and weight in water method. For dry matter content tubers were oven dried at a temperature of 72 ºC to a constant mass. Total dry matter content of the tubers was calculated as the ratio between dry and fresh mass expressed as a percentage.

### 10.3.4 Statistical analysis

The analyses of variance were carried out using MSTAT-C statistical software (MSTAT-C 1991). Means were compared using the least significant differences (LSD) test at the 5% probability level.

## 10.4 RESULTS

### Greenhouse experiments

The effect of MCPA and PBZ on the number of flowers and berries is presented in Table 10.1. Irrespective of the concentration and stage of application, a single foliar spray of MCPA or PBZ prevented flowering and completely inhibited berry set in potato (Fig. 10.1)

**Table 10.1. Number of flowers and berries after application of MCPA or PBZ at early or full flower bud stage: Greenhouse trial**

| Application | | MCPA | | PBZ | |
|---|---|---|---|---|---|
| Stage | Rate (mg plant$^{-1}$) | Number of flowers | Number of berries | Number of flowers | Number of berries |
| Early bud | 0 (control) | 44.67a | 5.67a | 48.9a | 6.1a |
| | 5 | 0.00b | 0.00b | 0.0b | 0.0b |
| | 10 | 1.33b | 0.00b | 0.0b | 0.0b |
| | 15 | 0.67b | 0.00b | 0.0b | 0.0b |
| Full bud | 0 (control) | 45.67a | 6.00a | 44.6a | 5.4a |
| | 5 | 2.00b | 0.00b | 1.30b | 0.0b |
| | 10 | 3.67b | 0.00b | 0.80b | 0.0b |
| | 15 | 1.00b | 0.00b | 0.00b | 0.0b |
| | SEM | 3.31 | 0.15 | 2.05 | 0.26 |

SEM: Standard error of the mean.

Means within the same column sharing the same letters are not significantly different ($P < 0.05$).


**Figure 10.1 Application of MCPA at a rate of 10 mg plant$^{-1}$ (B) and PBZ at a rate of 10 mg plant$^{-1}$ (C) inhibited berry set compared to the control (A)**

Table 10.2 shows the effect of MCPA and PBZ treatment on tuber number, yield and quality for the greenhouse trial. MCPA did not affect tuber number, yield, specific gravity and dry matter content. Similarly, PBZ treatment did not affect the number of tubers initiated. Regardless of the stage of application, however, PBZ increased tuber yield, specific gravity and dry matter content. PBZ treatment at a rate of 10 or 15 mg plant$^{-1}$ increased tuber yield by about 31% over the control. Irrespective of the concentrations, PBZ treatment increased specific gravity by about 1.5% and dry matter content by 27%. A strong correlation (r = 0.99**) was observed between tuber specific gravity and dry matter content.

**Table 10.2. Tuber number, yield, specific gravity, and dry matter content as affected by rates of MCPA and PBZ applied during early or full flower bud stage: Greenhouse trials**

| Treatment | MCPA greenhouse experiment | | | | PBZ greenhouse experiment | | | |
|---|---|---|---|---|---|---|---|---|
| | Tuber number ($pot^{-1}$) | Tuber yield ($g\ hill^{-1}$)* | Specific gravity ($g\ cm^{-3}$) | Dry matter (%) | Tuber number ($pot^{-1}$) | Tuber yield ($g\ hill^{-1}$)* | Specific gravity ($g\ cm^{-3}$) | Dry matter (%) |
| Stage | | | | | | | | |
| Early bud | 11.2a | 492(94)a | 1.043a | 12.7a | 11.5a | 510(92)a | 1.050a | 14.3a |
| Full bud | 9.3a | 485(93)a | 1.050a | 14.3a | 10.8a | 506(93)a | 1.048a | 13.6a |
| SEM | 0.88 | 17.8 | 0.003 | 0.63 | 0.68 | 18.6 | 0.002 | 0.52 |
| Rate (mg $plant^{-1}$) | | | | | | | | |
| 0 (control) | 11.3a | 483(92)a | 1.039a | 12.0a | 9.0a | 432(93)b | 1.038b | 11.6b |
| 5 | 11.7a | 514(94)a | 1.046a | 13.4a | 9.7a | 467(93)b | 1.052a | 14.2a |
| 10 | 10.5a | 494(93)a | 1.046a | 13.3a | 12.6a | 584(93)a | 1.055a | 15.2a |
| 15 | 7.5a | 465(95)a | 1.055a | 15.3a | 13.3a | 548(92)a | 1.052a | 14.8a |
| SEM | 1.25 | 8.94 | 0.004 | 0.89 | 0.96 | 24.7 | 0.003 | 0.73 |

* Figures in parenthesis represent the percentage of tubers larger than 50 g.

SEM: Stand error of the mean.

Means within the same treatment and column sharing the same letters are not significantly different ($P < 0.05$).

Table 10.3 indicates dry matter production and allocation as affected by MCPA and PBZ treatment in the greenhouse. The stage of application did not alter the effect of MCPA on total dry matter production as well as allocation amongst organs. Without affecting the total biomass production and assimilate partitioning to the underground parts, MCPA treatment decreased leaf and stem mass. PBZ treatment during the early flower bud stage resulted in a higher tuber mass than applying during the late flower bud stage. PBZ treatment decreased leaf mass while increasing tuber mass.

**Table 10.3. Total biomass production and allocation to the different parts of potato after a single application of MCPA or PBZ: Greenhouse trials**

| Treatment | Leaf (g) | Stem (g) | Fruit (g)* | Root & stolon (g) | Tuber (g) | Total biomass (g) |
|---|---|---|---|---|---|---|
| **MCPA** | | | | | | |
| Early bud | 20.3(17)a | 14.1(12)a | 11.30(10)a | 8.0(7)a | 65.2(55)a | 118.9a |
| Full bud | 18.6(16)a | 12.3(10)b | 11.28(9)a | 7.4(6)a | 69.6(58)a | 119.2a |
| SEM | 0.89 | 0.48 | 0.13 | 0.75 | 2.29 | 2.46 |
| 0 (control) | 22.7(19)a | 16.5(14)a | 11.3(10)a | 6.5(5)a | 61.2(52)a | 118.2a |
| 5 (mg plant$^{-1}$) | 18.9(17)ab | 12.8(12)b | 00.0(0)b | 9.0(8)a | 67.4(62)a | 108.2a |
| 10 (mg plant$^{-1}$) | 18.2(17)b | 12.0(11)b | 00.0(0)b | 8.0(7)a | 70.2(65)a | 108.4a |
| 15 (mg plant$^{-1}$) | 18.0(17)b | 11.6(11)b | 00.0(0)b | 7.3(7)a | 70.7(66)a | 107.6a |
| SEM | 1.26 | 1.15 | 0.19 | 1.05 | 6.27 | 6.91 |
| **PBZ** | | | | | | |
| Early bud | 20.0(15)a | 15.3(12)a | 13.5(10)a | 7.8(6)a | 72.5(56)a | 123.1a |
| Full bud | 19.2(16)a | 13.3(11)a | 13.6(11)a | 8.0(7)a | 66.5(55)b | 126.6a |
| SEM | 0.53 | 0.77 | 0.08 | 0.81 | 1.60 | 1.76 |
| 0 (control) | 23.0(20)a | 15.3(13)a | 13.6(12)a | 7.3(6)a | 55.9(49)c | 114.9a |
| 5 (mg plant$^{-1}$) | 19.2(17)b | 13.6(12)a | 00.0(0)b | 8.6(8)a | 68.6(62)b | 110.1a |
| 10 (mg plant$^{-1}$) | 17.2(15)b | 14.8(13)a | 00.0(0)b | 7.8(7)a | 76.9(66)a | 116.7a |
| 15 (mg plant$^{-1}$) | 18.8(16)b | 13.7(12)a | 00.0(0)b | 7.9(7)a | 76.6(65)ab | 117.0a |
| SEM | 1.05 | 1.69 | 0.12 | 1.14 | 6.05 | 6.31 |

Figures in parenthesis represent percentage of the total biomass.
* Mean values for the rates of MCPA and PBZ are the average of the three replications.

SEM: Stand error of the mean.

Means within the same treatment and column sharing the same letters are not significantly different ($P < 0.05$).

### Field experiments

The effect of MCPA and PBZ on the number of flowers and berries of potato grown under field conditions is presented in Table 10.4. Irrespective of the concentration and stage of application, a single foliar spray of MCPA or PBZ prevented flowering and completely inhibited berry set.

**Table 10.4. Number of flowers and berries after application of MCPA or PBZ at early or full flower bud stage: Field trials**

| Application | | MCPA | | PBZ | |
|---|---|---|---|---|---|
| Stage | Rate (g $ha^{-1}$) | Number of flowers | Number of berries | Number of flowers | Number of berries |
| Early bud | 0 (control) | 53.33a | 4.33a | 54.7a | 5.62a |
| | 250 | 3.00b | 0.00b | 1.6b | 0.0b |
| | 500 | 0.53b | 0.00b | 0.0b | 0.0b |
| | 750 | 0.00b | 0.00b | 0.0b | 0.0b |
| Full bud | 0 (control) | 52.33a | 5.47a | 47.3a | 5.91a |
| | 250 | 1.83b | 0.00b | 0.0b | 0.0b |
| | 500 | 0.00b | 0.00b | 2.03b | 0.0b |
| | 750 | 0.00b | 0.00b | 1.23b | 0.0b |
| | SEM | 2.15 | 0.39 | 1.80 | 0.16 |

SEM: Standard error of the mean.

Means within the same column sharing the same letters are not significantly different ($P < 0.05$).

The effect of MCPA and PBZ on yield and quality of potato is indicated in Table 10.5. MCPA did not affect tuber number, yield, specific gravity or dry matter content. Without affecting tuber number, specific gravity and dry matter content, early PBZ treatment resulted in better tuber yield than late application. Applying 500 or 750 g of PBZ $ha^{-1}$ increased tuber yield by about 24%, specific gravity by 1.2%, and dry matter content by 19% over the control. There was a strong correlation (r =0.99**) between specific gravity and dry matter content.

**Table 10.5. Tubers number, tuber mass, specific gravity, and dry matter content of potato as affected by rates of MCPA and PBZ applied during early or full flower bud stages: Field trials**

| Treatment | MCPA field experiment | | | | PBZ Field experiment | | | |
|---|---|---|---|---|---|---|---|---|
| | Tuber number ($hill^{-1}$) | Tuber mass ($g\ hill^{-1}$)* | Specific gravity ($g\ cm^{-3}$) | Dry matter (%) | Tuber number ($hill^{-1}$) | Tuber mass ($g\ hill^{-1}$)* | Specific gravity ($g\ cm^{-3}$) | Dry matter (%) |
| Stage | | | | | | | | |
| Early bud | 16.2a | 681(84)a | 1.055a | 15.3a | 17.01a | 752(77)a | 1.052a | 14.6a |
| Full bud | 17.6a | 671(82)a | 1.058a | 16.0a | 17.41a | 655(82)b | 1.058a | 15.9a |
| SEM | 0.88 | 30.1 | 0.002 | 0.46 | 0.57 | 31.1 | 0.002 | 0.45 |
| Rate ($g\ a.i.\ ha^{-1}$) | | | | | | | | |
| 0 (control) | 16.1a | 681(80)a | 1.053a | 14.9a | 16.1a | 610(79)b | 1.047b | 13.6b |
| 250 | 19.0a | 750(84)a | 1.058a | 15.9a | 18.0a | 693(82)ab | 1.054ab | 15.1ab |
| 500 | 15.0a | 595(85)a | 1.057a | 15.7a | 17.3a | 723(82)a | 1.058a | 15.9a |
| 750 | 17.2a | 678(84)a | 1.059a | 16.2a | 17.5a | 790(84)a | 1.061a | 16.5a |
| SEM | 1.25a | 42.6 | 0.003 | 0.65 | 0.81 | 37.0 | 0.003 | 0.64 |

* Figure in parenthesis represents the percentage of tubers larger than 50 g.

SEM: Stand error of the mean.

Means within the same treatment and column sharing the same letters are not significantly different ($P < 0.05$).

Table 10.6 shows the effect of MCPA and PBZ on dry matter production and allocation to the different organs of potato grown under field conditions. Application of MCPA at early and full flower bud stages did not affect the dry mass of the different organs. Regardless of the concentration, MCPA reduced total biomass yield by about 11% compared to the control treatment. MCPA did not affect leaf, root or tuber dry mass, but decreased stem dry mass by about 27% l.

**Table 10.6. Total biomass production (per hill) and allocation to the different plant components after a single application of MCPA or PBZ under field condition**

| Treatment | Leaf (g) | Stem (g) | Fruit (g)* | Root & stolon (g) | Tuber (g) | Total biomass (g) |
|---|---|---|---|---|---|---|
| **MCPA** | | | | | | |
| Early bud | 39.3(26)a | 18.8(12)a | 10.3(7)a | 6.3(4)a | 77.1(51)a | 151.8a |
| Full bud | 35.3(24)a | 17.9(12)a | 10.2(7)a | 5.4.(4)b | 77.0(53)a | 145.8a |
| SEM | 1.32 | 0.66 | 0.17 | 0.27 | 1.91 | 2.60 |
| 0 (control) | 39.8(26)a | 23.0(15)a | 10.3(7)a | 6.1(4)a | 74.8(49)a | 154.1a |
| 250 (g $ha^{-1}$) | 36.1(26)a | 17.2(12)b | 00.0(0)b | 5.6(4)a | 79.5(57)a | 138.4b |
| 500 (g $ha^{-1}$) | 36.3(26)a | 15.4(11)b | 00.0(0)b | 5.6(4)a | 81.9(59)a | 139.2b |
| 750 (g $ha^{-1}$) | 37.0(28)a | 17.8(13)b | 00.0(0)b | 6.2(4)a | 71.9(54)a | 133.0b |
| SEM | 1.87 | 0.94 | 0.23 | 0.39 | 2.70 | 3.67 |
| **PBZ** | | | | | | |
| Early bud | 29.9(21)a | 15.4(11)a | 11.8(8)a | 6.7(5)a | 80.0(55)a | 143.8a |
| Full bud | 34.1(23)a | 19.5(12)a | 11.7(8)a | 6.0(4)a | 81.2(54)a | 152.5a |
| SEM | 1.73 | 1.07 | 0.23 | 0.32 | 1.49 | 2.69 |
| 0 (control) | 37.0(24)a | 21.1(14)a | 11.9(8)a | 7.6(5)a | 75.1(49)b | 152.7a |
| 250 (g $ha^{-1}$) | 29.9(22)b | 15.1(11)b | 00.0(0)b | 6.0(5)b | 82.2(62)a | 133.3b |
| 500 (g $ha^{-1}$) | 30.3(22)b | 17.9(13)ab | 00.0(0)b | 6.3(5)ab | 80.2(59)ab | 134.8b |
| 750 (g $ha^{-1}$) | 30.9(23)ab | 15.7(11)b | 00.0(0)b | 5.7(4)a | 84.6(62)a | 136.9b |
| SEM | 1.73 | 1.52 | 0.32 | 0.45 | 2.11 | 3.80 |

Figures in parenthesis represent percentage of the total biomass.

* Mean values for the rates of MCPA and PBZ are the average of the three replications.

SEM: Stand error of the mean.

Means within the same treatment and column sharing the same letters are not significantly different P < 0.05).

The stage of application did not affect the impact of PBZ on dry matter production and allocation amongst organs. Irrespective of the concentration, PBZ treatment reduced total biomass yield by about 12%. Of the total carbon fixed, PBZ treated plants allotted 22% to the leaves, 12% to the stems, 5% to the roots and 61% to the tubers, while the untreated ones partitioned 24%, 14%, 8%, 5% and 49% to the leaves, stems, berries, roots and tubers, respectively.

## 10.5 DISCUSSION

The relatively poor fruit set observed in the control treatments could be due to high temperatures during the growing period. High temperatures during flowering may inhibit pollen tube growth and fertilization and cause abscission of flowers (Howard, 1970). In both experiments, MCPA controlled berry set by promoting flower bud abscission before flower unfolding. This could be attributed to inhibition of cell division and elongation. MCPA belongs to the growth regulator herbicides that have multiple sites of action in the plant and disrupt the hormonal balance as well as protein synthesis, thereby causing growth abnormalities (Ashton & Crafts, 1981). Veerman & Van Loon (1993) reported that application of MCPA (500 or 750 g $ha^{-1}$) at early or full flower bud stage reduced berry number and seed number per berry. Application of MCPA at early bud stage is ideal for decreasing berry set (Wedgwood, 1988; Veerman & Van Loon, 1993). Albeit not statistically significant, early application of MCPA consistently increased tuber yield in the greenhouse and field trials at the University of Pretoria.

Reproductive development includes the processes from flower bud initiation to fruit development (Pharis & King, 1985). There is evidence indicating that GA is involved at various stages of reproductive development, and that GA application can influence different stages of the process (Mamat & Wahab, 1992; Robers *et al.*, 1999, Brooking & Cohen, 2002). PBZ treatment promoted flower bud abscission and prevented berry set in both trials. This may be linked to a reduction in endogenous GA levels. Gibberellins are involved during early flower bud development prior to anthesis (Pharis & King, 1985). In flowers of dicotyledonous species a transitory increase in GA content prior to anthesis has been observed, suggesting that GA is involved in either or both flower opening and anthesis (Pharis & King, 1985; Sagee & Erner, 1991). Inhibitors of GA biosynthesis such as CCC and AMO-1618 block flowering in a number of long day plants, some short day plants, and some cold requiring plants. This effect can be reversed by GA treatment under both short and long day conditions (Zeevaart, 1964; Vince-Prue, 1985).

Since the plants were grown under relatively high temperatures that encourage excessive top growth the untreated plants exhibited higher haulm dry mass than the treated plants. High temperatures decrease the partitioning of assimilates to the tubers and increase partitioning to other parts of the plant (Wolf *et al.* 1990; Vandam *et al.* 1996). MCPA and PBZ treatments influenced total biomass production and assimilate partitioning. Tubers were the dominant sinks that attracted the highest proportion of the dry matter. This dominance may be linked to lower endogenous GA levels in tuber tissue in response to the treatments. Menzel (1980) and Mares *et al.* (1981) reported that exogenous application of $GA_3$ inhibited tuber formation, decreased tuber sink strength and encouraged shoot and stolon growth. The increase in tuber yield as well as dry matter content in response to the treatments may partly be due to the absence of competition between developing tubers and berries. Manually removing flowers and berries increased tuber specific gravity and dry matter content (Tsegaw & Zelleke, 2002). The observed strong positive correlation between specific gravity and dry matter content indicates that specific gravity is a true indicator of dry matter content of tubers.

## 10.6 CONCLUSION

The greenhouse and field trials demonstrated that MCPA and PBZ effectively prevented flower formation and berry set in potato without negatively affecting tuber yield and quality. Application of the two chemicals during the early flower bud stage gave slightly higher tuber yields than late application. The trials were conducted using only one cultivar and under suboptimal conditions for berry formation, therefore, further field trials must be conducted to formulate legitimate recommendations. Detailed field trials using cultivars with different degrees of flowering and berry formation will be conducted under tropical highland conditions in Ethiopia.