ISOPROPYL N-(3-CHLOROPHENYL) CARBAMATE (CIPC) RESIDUES IN POTATOES TREATED WITH FOG AND DUST FORMULATIONS DURING STORAGE

Brajesh Singh and R. Ezekiel

Central Potato Research Institute, Shimla-171 001, HP, India

Abstract: Potatoes (cv. Kufri Lauvkar) stored at 10 and 12°C were treated with two formulations of CIPC, viz., aerosol and dust and residue levels were determined periodically. Aerosol formulation applied as fog resulted in more even distribution as indicated by higher level of CIPC residue in peels and unpeeled tubers. However, the highest CIPC residue level observed was much below the acceptable limit.

Isopropyl N-(3-chlorophenyl) carbamate (CIPC) is a well known sprout suppressant for potatoes and has been extensively used world over for sprout suppression during storage. It continues to be the dominant chemical being used for sprout suppression in potatoes (Anon., 2002). Various formulations of this chemical have been tried on potatoes to achieve sprout suppression viz., powder/dust application, dip treatment and application of aerosol (Kleinkopf et al., 1997). However, CIPC was registered for use in India only in 1998 and is being used on table and processing potatoes since then. The chemical is available in liquid form and is applied as hot fog in commercial cold stores. CIPC is also applied in the form of dust when the quantity of potatoes stored is small. As CIPC treated potatoes are being used for table and processing purposes, due to health concerns it has become essential to determine CIPC residues in treated potatoes. The present study was aimed at determining CIPC residues in potatoes treated with CIPC to ascertain whether the residues are within the acceptable limit and also to compare CIPC residue levels in tubers treated with aerosol formulation with that of the tubers treated with dust formulation.

The experiment was carried out at the Central Potato Research Institute, Shimla during 2002 using tubers of cultivar Kufri Lauvkar grown at CPRS, Gwalior following recommended package of practices for the region. The tubers were stored in netted nylon bags in walk-in-chambers maintained at 10 and 12°C with 85% RH during first week of April. For aerosol application commercial preparation of CIPC called “Oorja” manufactured by United Phosphorus Limited, Mumbai was used, which is a liquid formulation containing 50% active ingredient. The application was made in sealed walk-in-chambers in the form of thermal aerosol (hot fog) through an inlet fixed at about 2 feet above the ground level. A fogger (Dyna fog, USA) was used for CIPC application and the dose applied was 40 ml per tonne of potatoes. After treatment the store was closed for 48 hours to allow CIPC aerosol to settle down on the potatoes. Whereas for dust application, 100 tubers of cultivar Kufri Lauvkar were separately treated with CIPC dust (1% active ingredient in saw dust applied @ of 30 mg a. i. /kg of tubers). The tubers were treated in a plastic container and rotated thoroughly for uniform distribution of dust. The container was sealed for 48 hours. These tubers were stored in walk-in-chambers at 10 and 12°C along with the tubers treated with CIPC aerosol. First treatment of CIPC was done on April 16 and the second application was done on May 30. During second fogging the previously dusted tubers were removed from the chambers, treated separately with dust and after treatment the tubers were again stored in the walk-in-chambers. For sampling, ten tubers each were collected randomly to make a composite sample per treatment for CIPC residue analysis. CIPC residue was determined in unpeeled whole tubers and peels (consisting of the skin and approximately 2mm of the flesh) in composite samples. The extraction of CIPC from tuber samples was done by the standardized method (Singh et al., 2004). The residues were determined using HPLC (high performance liquid chromatograph) after modifying the procedure developed by Wilson et al. (1981). The sample equivalent to 1g tissue was injected into the system for quantification which was done by comparing the peak area with that of the standard curve.

The trend of persistence of CIPC residues on peels and in unpeeled tubers was studied by determining CIPC residues at periodical intervals. At both the storage temperatures i.e. 10 and 12°C, the CIPC residues in peels of the tubers treated with CIPC aerosol showed a similar trend. It was high (9.95 and 4.25 mg/kg fresh weight, respectively) on 10th May, decreased before the second fogging (on 17th May) and showed a sharp increase immediately after second fogging. Thereafter, the residues continued to decline till the end of storage period. However, with dust treatment, the CIPC residue level did not show an increase after second treatment (Fig. 1A and 1B). When CIPC was applied in the form of aerosol, the CIPC residues in the peels were higher in comparison to dust application, indicating the increased efficiency of aerosol application. In the unpeeled tubers, the CIPC residue level showed a decline at 10°C and there was no increase after second fogging and dusting in these tubers. But in tubers stored at 12°C, there was an increase in the CIPC residue level immediately after second...
fogging and dusting (Fig. 1C and 1D) as was observed in the residues from peels. However, the trend obtained at 10°C is difficult to explain. Here again, the residues were higher in tubers treated with aerosol than with dust, showing better efficiency of aerosol application.

CIPC residues were almost 10 times higher in peels than the unpeeled tubers as reported earlier also (Singh et al., 2004). The non-systemic nature of CIPC may be the cause for its restricted penetration into the tuber, which results in more residues on surface layer (peels) than the unpeeled whole tuber (peel and cortex together). The environmental protection agency (EPA) had worked out a maximum residue level (MRL) for CIPC to be 30 mg/kg in potatoes (EPA, 1996). In none of the tuber samples we observed the residues to be near to or above this level indicating thereby that the treated tubers were safe for human consumption. The results reported here clearly show that two applications of CIPC as aerosol formulation are required for effective suppression of sprout growth (data not shown) in potatoes during prolonged storage at 10 and 12°C.

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